SCIENTIFIC AMERICAN

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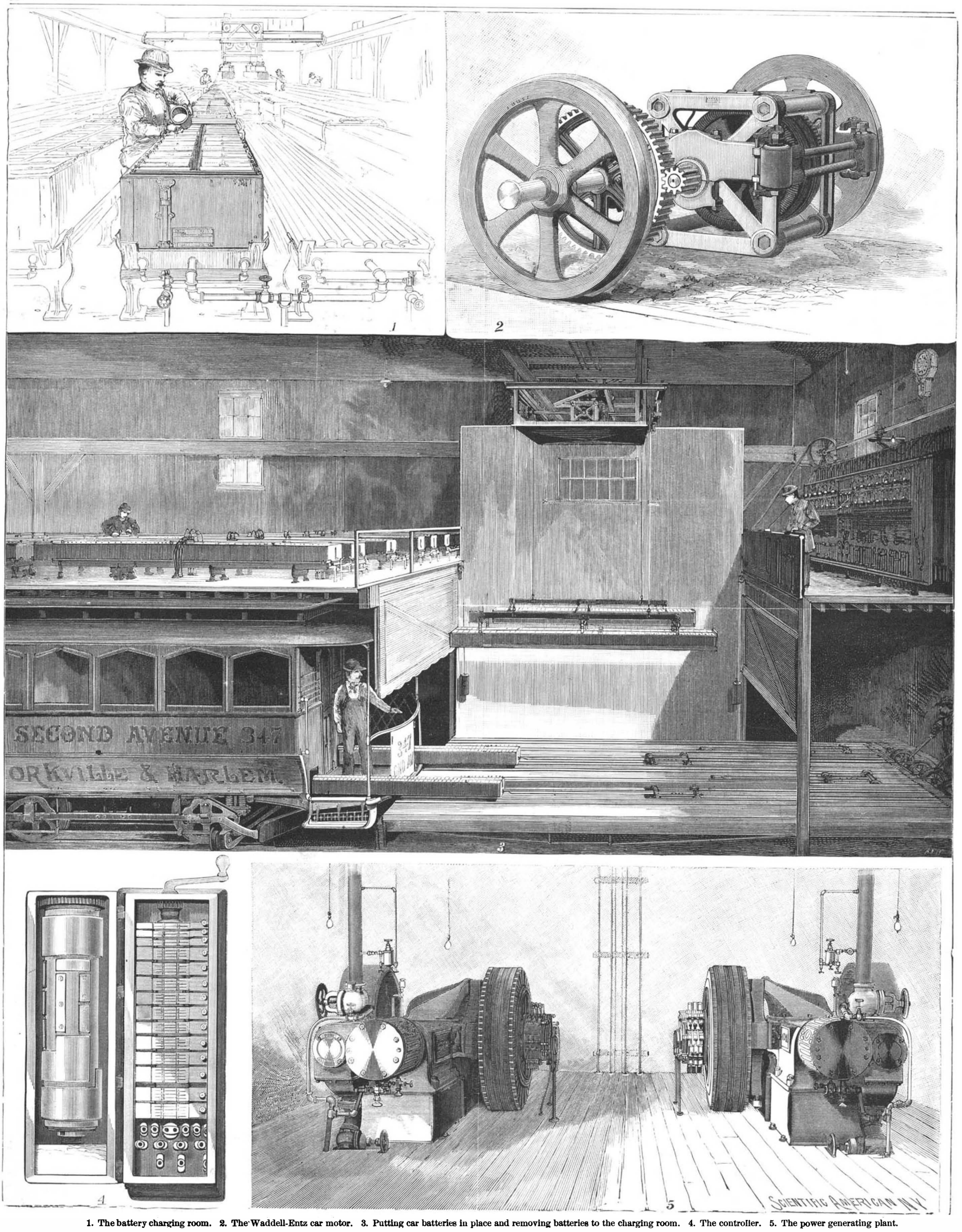

1. The battery charging room. 2. The Waddell-Entz car motor. 3. Putting car batteries in place and removing batteries to the charging room. 4. The controller. 5. The power generating plant.

THE STORAGE BATTERY SYSTEM ON THE SECOND AVENUE RAILROAD, NEW YORK CITY.—[See page 184.]

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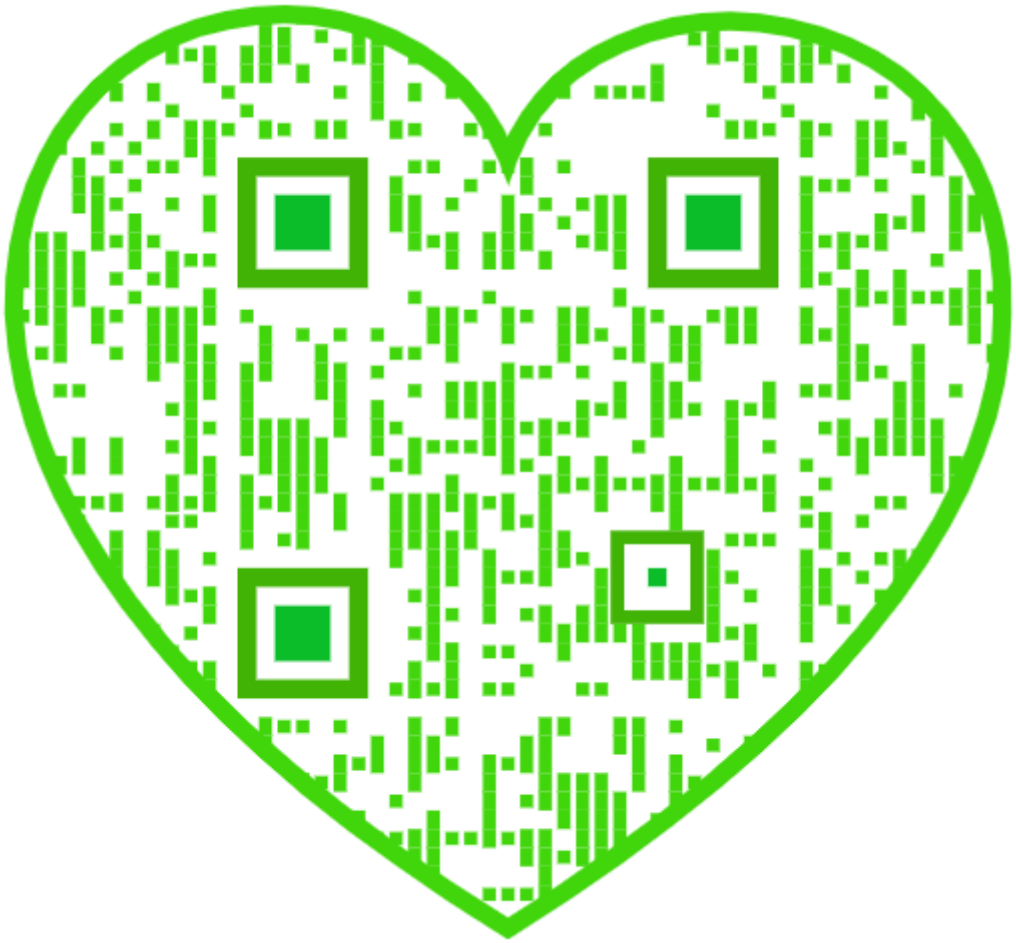

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REMARKABLE BOAT SPEED—32½ MILES PER HOUR.

The breath of brag in which some of our boat builders have indulged concerning certain American vessels is cut short by the performances of some of the new torpedo boats recently constructed for the British navy. The latest vessel of this class, the Hornet, on a recent trial trip, attained the remarkable speed of 28·33 knots, or over 32½ miles per hour.

This vessel is 180 feet long and 18½ feet wide, has eight boilers, and four funnels. Displacement, 220 tons; greatest draught, 7 feet 6 inches; estimated horse power, 6,248. The trial took place on February 23, on the Maplin mile. Six runs were made, the mean speed being 28·02, and the best pair of runs being 28·333 knots. The bunker capacity is 60 tons, and on this supply, at 10 knots, the boat would have a radius of action of 4,000 miles. Her armament consists of one 12 pounder, two 6 pounders, and three torpedo tubes, 18 inches. The Hornet is a sister boat to the Havock, which was illustrated and described in the SCIENTIFIC AMERICAN of January 13 last.

The Havock made a speed of 27·56 knots. Some forty of these boats are being built in England. Remarkable as is the speed of the Hornet, a boat which is expected to go still faster is now being constructed in France.

The following are particulars of the sea-going torpedo boat Forban, which is now being built at Havre by MM. Augustin Normand & Co., and which is designed to attain the extraordinary speed of 30 knots or 34½ statute miles an hour. Length, 144 feet 3 inches; beam, 15 feet 3 inches; draught, 10 feet; displacement, 130 tons; indicated horse power, 3,200. The vessel will have twin screws, and will carry two torpedo ejectors and two 1·46 inch guns. The Forban will be by far the fastest craft afloat. The Chevalier, a torpedo boat of the same length, but of only 2,700 indicated horse power, was recently delivered by MM. Normand, and has attained a speed of 27·22 knots. The boilers which give these striking results are a specialty of the firm of Normand, and are, it is understood, to be adopted for the new British torpedo boat destroyers Janus, Porcupine, and Lightning, under construction by Messrs. Palmer & Co., of Jarrow, and for the Rocket, Shark, and Surly, under construction by Messrs. J. & G. Thomson, of Clydebank.

In view of these new advances in naval construction, it is to be hoped Congress will wake up to the necessity of ordering a few vessels of equal speeds to the foregoing. At present we believe the fastest craft in the American navy is between eight and ten miles an hour slower than these new vessels of the Royal navy.

THE IMPERFECTIONS OF THE OVERHEAD TROLLEY SYSTEM.

At the recent convention of the National Electric Light Association, some very suggestive topics were treated in the papers read before the assembly. One which has attracted most attention was written by Mr. J. H. Vail on the trolley system, with reference to the harm incident to the present system of construction of the return or ground circuit. As is generally known, the trolley system uses an aerial conducting system of bare copper wire, often including a feeder and trolley line running parallel with each other. This system connects with one of the generator station bus rods or terminals, while the other bus rod or terminal connects with the rails and perhaps with a bare wire laid in the earth alongside of them. At the joints the rails are connected by one or two short wires, which prevent dangerous heating at these points. The car motors operate in parallel with each other, the trolley connections bridging the interval between rail and trolley wire, the car wheels acting as conductors to the rails. Mr. Vail's paper went to show that this system was a bad one and produced ill effects besides being uneconomical.

The earth treated as a conductor has long been taken as of no resistance. But like many other things in electricity, this appears better in statement than it proves in realization. For while we may take the statement as correct regarding the earth proper, the problem to be solved is how to secure contact with the earth. A zero resistance of the earth proper may be supplemented by any number of ohms of resistance at the earth plates or other grounding device employed.

The essence of economy in a parallel arc system, such as the electric railroad, is the approximate uniformity of potential at all parts of the line; if a railroad, the potential should not drop greatly, even when the cars are running. This approach to uniformity is a factor which, in a railroad, must become less satisfactory as more cars are used. It is also militated against by high line resistance. With the disappearance of the old-time zero resistance of the earth, the return circuit appears as an important element in the construction. Mr. Vail detailed the result of tests made by him in which a station pressure of 500 to 550 volts was reduced on the line to 300 to 325 volts. This means a loss of nearly one-half the energy supplied—a loss sufficient to seriously affect the running expenses, as well as to involve higher capitalization at the stations. This loss, of course, brings about the necessity for a larger generating plant than would be otherwise necessary.

This is not the most striking part of the subject, however. The return circuit through the rails and parallel wire being in contact with the earth, branch currents go off in all directions, and neighboring water and gas pipes take up a share of the work of the return conductors. The story is told of a person in Boston or its vicinity who got current enough from his water or gas pipe in his house to run a motor. Whether correct or not, the story is a good one. But the current, in going through the moist soil from rail or wire to gas or water pipe, and in its return, is accompanied by electrolysis of the moisture of the soil, which brings about the corrosion of one of the electrodes, which, of course, are the pipes and wires.

Some very remarkable results were cited by Mr. Vail. In one case a pipe was quite destroyed. This goes to show that the trolley system as at present installed not only menaces life, but also property. The electrolyzing of a pipe, bringing about a gas or water leak, may involve a very large amount of damage.

The remedy, as suggested by the writer of the paper referred to, is to use one or more low resistance metal insulated return wires, laid in parallel with the rails and connected at frequent intervals thereto. The rail joints he also would have adequately connected, not as at present with thin wire of relatively small capacity. The heavy wires parallel with the tracks would represent feeders.

The saving of copper on an electric supply line is very poor economy. It is obvious that the improvement suggested by Mr. Vail would cost a good deal; but the ultimate saving in running expenses would justify the improvement in many cases. It also is wrong to permit the maintenance of a system so imperfect as to involve injury to other property.

The paper is a very suggestive one, and emphasizes the lesson which experience has so slowly taught electric engineers—the importance of good installation. The trolley system has gone through years of tribulation because it was, in its early examples, too cheaply erected. To-day its success is measured by and due to the good quality of its installation. It is to be hoped that the next improvement, and it may cost more, will be the introduction of a practical underground conduit for electric car propulsion.

The California Midwinter Fair.

The success of the Fair is now assured. The first week's attendance was 124,282; second week, 60,459; third week, 61,192; and the fourth week, 122,743. A feature of the Fair is special days. On February 23 was children's day, when 55,871 persons passed the turnstiles, the second largest single day attendance since the Fair opened. On February 22 the awards for fruit were made, representing the southern counties of California. The County of San Bernardino had the best fruit and made the finest exhibit. We believe it shared well also in the California exhibit at the Chicago Fair. One of the important features of the Fair is a representative mining camp, arranged just as it appeared when the forty-niners created such an excitement. There is a Manufacturers' building, Machinery Hall, Art building, Horticultural Hall, an ostrich farm, street in Cairo, Esquimaux and Indian villages, the Firth wheel, and numerous other side attractions, which are interesting to see. The foreign exhibits, except in the Chinese and Japanese line, are not extensive.

Draining of Lake Copais.

The draining of Lake Copais has led to discoveries far beyond what was at first anticipated. Not only has an elaborate system of aqueducts been laid bare, of which we hope later to give full particulars, but in the bed of the lake traces of an ancient settlement have been found, and according to the *Berliner Philologische Wochenschrift* the ground plan of a palace has been made out, which in main outline corresponds to that of Tiryns. Thus it seems that the myth of the flooding of the plain by Herakles corresponded to some actual fact. From the bed of the lake we may hope to recover traces of that ancient civilization to which we attach the name of the hitherto fabulous Minyae. To this race belonged the Argonauts, and, if recent theory be correct, the women hosts of the Amazons. This buried city has been kept intact from the chance marauder by the waters of the lake; we may, therefore, reasonably hope it will yield a rich treasure to the scientific explorer.

The Congress of American Physicians and Surgeons.

This congress is to meet in Washington on May 29, 30, and 31, and on June 1 next, under the presidency of Dr. Alfred L. Loomis, of New York. The congress is a conjoint triennial meeting at Washington of certain national medical societies, so arranged that while each society preserves its autonomy and has its own meetings, papers, and discussions, the members of all the societies meet together at stated hours to carry out the objects of the congress.

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Planet Notes for April.

H. C. WILSON.

Mercury will be "morning star" during April, and will be at greatest elongation, west from the sun 27° 40′, on the tenth of the month. Mercury will be in conjunction with the moon April 3, at 5 h. 37 m. P. M. central time.

Venus is also "morning star," and is nearing greatest elongation west from the sun. The greatest distance from the sun, 46° 10′, will be reached on the morning of April 27. This will be a favorable month, so far as position is concerned, for the study of the surface markings of Venus, although the fact that she is only visible in the morning will be a drawback to all but the most enthusiastic amateurs. On the morning of April 5 Venus will be near the star α Aquarii, conjunction in right ascension occurring at 2 h. 17 m. A. M. central time. Venus will then be 19′ south of the star. The illuminated portion of her disk will increase during the month from one-third to one-half, while her brilliancy will decrease in the ratio of 195 to 139.

Mars improves a little in position during April, but it will not yet pay to spend much time in trying to observe this planet. He will move eastward and northward through the center of the constellation Capricornus. As he is brighter than any of the stars in the constellation, it would not be difficult to identify him without the ruddy color which makes him so conspicuous. Mars will be in conjunction with the moon April 29, at 1 A. M.

Jupiter will be pretty low in the west during the observing hours of April, but some satisfactory views may yet be obtained. He is moving slowly eastward south of the Pleiades. Jupiter will be in conjunction with the moon, 5° south, April 9, at 5 A. M.

Saturn and *Spica* (α Virginis) make a fine pair in the south in the morning. They are nearly equal in brilliancy but differ a little in color, Saturn having a golden hue while Spica is bluish-white. Saturn is retrograding, that is moving westward, and at the end of April will be almost directly north of Spica. He will be at opposition April 11, at noon. The moon will pass by Saturn, 4° to the south, April 10, at 9 h. 28 m. P. M.

Uranus is toward the southeast from Saturn in the constellation Libra. On the morning of the 27th, at 7 h. 11 m., he will be in conjunction with the second magnitude star α Libræ, being only 4′ north of the brighter component of that star, which is a wide double. The motion of Uranus is so slow that he will be in the vicinity of the star for several days, so that this will be an excellent opportunity for the amateur to be sure that he has seen this planet. Note the green color and the visibility of a definite disk.

Neptune may be observed in the early evening, but has passed the most favorable position. He is about half way between ι and ε in the constellation Taurus.

There will be an annular eclipse of the sun, April 5, 1894, not visible in the United States. The path of the annular eclipse passes from a point in the Persian Gulf across Hindostan and China, along the east coast of Siberia, ending in Alaska. It will be visible as a partial eclipse throughout Asia, northeastern Europe, and parts of the Indian and Pacific Oceans.

CIRCUMSTANCES OF THE ECLIPSE.

	Greenwich time.	Long. from Greenwich.	Latitude.
	h. m.	Deg. Min.	Deg. Min.
Eclipse begins April 5,	13 15·9	72 24·2 E.	6 33·6 S.
Central eclipse begins	14 24·0	53 51·8 E.	6 47·4 N.
Central eclipse at noon	16 27·7	113 42·5 E.	47 22·3 N.
Central eclipse ends	17 23·3	157 30·7 W.	62 47·5 N.
Eclipse ends	18 31·5	179 34·2 W.	49 44·5 N.

—*Popular Astronomy.*

The Washington Meeting of the National Electric Light Association.

The seventeenth convention of this association was held in Washington, D. C., on February 27 and 28 and March 1 and 2. The officers, as elected at the meeting, included the following: President, Mr. M. J. Francisco, of Rutland, Vt.; First Vice-President, Mr. C. H. Wilmerding, of Chicago, Ill.; Second Vice-President, Mr. Frederic Nichols, of Toronto, Can. Some very excellent papers were read. One by Mr. Charles F. Scott, on the polyphase system of transmission and utilization of electric energy, attracted many encomiums. The author showed that by specially designed converters a two-phase alternating current could be converted into a three-phase, or *vice versa*. Thus two and three phase apparatus could be included in the same system. Prof. Rowland stated that he considered that Mr. Scott's paper marked a new era in polyphase transmission—certainly a very high compliment.

"Arc Lights on Incandescent Circuits," "Meters vs. Flat Rates," the Howard incandescent lamp, and the subject of municipal ownership are examples of the topics treated and discussed.

Among the committee reports, one, on the rating of arc lamps, presented by Prof. Anthony, recommended the defining of the present 2,000 candle power lamp as a 450 watt lamp, and favored the abandonment of the attempt to rate lamps by any direct expression of candle power. A very exhaustive report by the committee on the National Electric Light Association's standard rules for electrical construction and operation was read. This reiterated the necessity of good installation. Another report was on coal consumption in generating electricity. It showed a wide variation in results, the figures from reports of a number of different works ranging from 25 up to 208 watt hours per pound of coal—an average of 91·7 watt hours or over seven pounds of coal per electric horse power per hour, which was not considered a very satisfactory showing.

Professor T. C. Mendenhall was introduced to the convention, before which he presented a plea for its aid in securing the passage of an act legalizing the electric units as adopted at Chicago. The convention at once took the action requested.

What is Chemistry?

Everybody who thinks must be impressed by the great variety of things found on this earth, and the question, What does the earth consist of? must often suggest itself. Among the important results reached in studying the things around us is this, that notwithstanding their great variety they are made of simple things and these in turn of still simpler—that there are in fact only about seventy distinct kinds of matter, and that all the complex things around us are made up of these seventy elements. The solid crust of the earth as far as it has been possible to investigate it, all living things, both animals and plants, the air and water, consist essentially of twelve elements. The elements do not, as a rule, occur as elements. They are generally found in combination with one another. Oxygen and nitrogen are, to be sure, found in the air as elements, uncombined; but such familiar substances as water, salt, and quartz consist of elements in combination. Thus water consists of hydrogen and oxygen. Hydrogen, the element, is a colorless, tasteless, inodorous, and very light gas that burns readily. Oxygen, the element, is also a colorless, tasteless, inodorous gas. It does not burn, but burning things burn with much increased brilliancy in it. When hydrogen and oxygen are mixed together in a vessel under ordinary conditions, no action takes place. They mix thoroughly, forming a mixture that is also a colorless, tasteless, inodorous gas. If a spark is applied to this mixture, a violent explosion occurs, and this is the signal of a great change. The two gases have entered into chemical combination; they are no longer the gases hydrogen and oxygen; they have entered into combination and now form the liquid water, a substance with properties entirely different from those possessed by the constituents.

Again, chlorine, the element, is a greenish-yellow gas that acts violently upon other things and causes changes in them. Inhaled even in small quantity it gives rise to distressing symptoms, and in larger quantity it causes death. Its odor is extremely disagreeable. Sodium, the element, is an active substance, that has the power to decompose water and set hydrogen free. When chlorine gas is brought together with sodium, the two combine chemically and form the well known compound salt, or, as the chemist calls it, sodium chloride. From this, the elements chlorine and sodium can be obtained by the chemist. These two examples serve to show what is meant by chemical combination and by a chemical compound. Chemical compounds are generally found mixed with other compounds. This is shown, for example, in many of the varieties of rocks, as granite, which consists of three different chemical compounds. It is shown much more strikingly in living things, all of which are made up of a large number of chemical compounds, mixed, to be sure, not in a haphazard way, but beautifully adjusted and working together in wonderful harmony.

Just as elements combine chemically to form compounds, so elements act upon compounds and cause changes in their composition. Thus, oxygen is constantly acting upon other things, sometimes slowly, but, in the case of fire, rapidly and with tremendous energy. It is commonly said that fire destroys things. In fact, it changes their composition, and the principal products of the change are gases. This kind of chemical change is the most familiar that is brought about by the action of an element upon compounds. Compounds, too, act upon compounds, and cause an infinite number of changes in composition. Thus the food we partake of consists of chemical compounds. In the body these compounds find others and they act upon one another so as to repair the wasted tissues and cause growth. The gas known as carbonic acid, that is contained in the air, acts upon the compounds in the leaves of plants and causes changes that are absolutely essential to the life and growth of the plant.

Look, then, in any direction and you will see evidence of changes in composition that are constantly taking place, and that are essential to the existence of the world as it is. These changes in composition and the compounds themselves that are involved in the changes form the subject of chemistry. In the light of what has been said it is clear that chemistry must be a very broad science. Remembering that chemical action is the cause of the formation of chemical compounds, that without chemical action the compounds would cease to exist and would be resolved into their elements, it is impressive to think what would take place if chemical action should cease. Most of the things familiar to us could not exist. The solid portions of the earth would to a large extent be replaced by the element silicon, something like charcoal, and by oxygen and a few metals such as sodium, potassium, and aluminum. Water would be resolved into the two gases hydrogen and oxygen. All living things would fall to pieces, and in their place we should have the gases hydrogen, oxygen, and nitrogen, and the solid element carbon, most familiar to us in the form of charcoal. Life would, therefore, be impossible.—*Prof. Ira Remsen, in the Chautauquan.*

Electric Heating.

From an interesting article in the *Electrical Engineer* we take the following, by W. S. Hedaway, Jr.:

A well designed central station of moderate size produces a horse power hour by the combustion of about 3 pounds of good coal. The electrical horse power hour developed by this coal has 2,565 heat units; we have to balance these 2,565 heat units in the concentrated form against 42,000 heat units existent in the three pounds of coal in a more diffused state and determine whether, for heat purposes, the difference in the form of the energy, with its enormous attendant losses, compensates for the energy lost in bringing the heat units of coal into the higher form of energy capable of economical transmission to a distance.

It is found in practice that the commercial efficiency of the coal cooking range is somewhere between 3 and 6 per cent; these limits are stated by Tyndall. In a recent discussion before the London Society of Engineers, November 6, 1893, Mr. Beaumont gives the efficiency of the cooking range from experiments of his own as 3·7 per cent, or roughly 4 per cent, indicating, that of every 27 pounds of coal burned, 26 pounds are thrown away. We have seen that the heat efficiency of the average moderate size central station is about 6 per cent. There is sufficient margin between a heat efficiency of 3·7 per cent and one of 6 per cent to warrant the use of electricity as a source of heat in domestic life, and a further extension with apparatus of larger size and higher working economy would give a still greater margin between coal burned under the boiler and that used in the firepot of the range. Thus with the use of only 1½ pounds of coal per horse power hour he would secure a commercial efficiency of 12·2 per cent or 3 3 times the efficiency of the range.

At the outset, of course, the cost of electrical energy as fuel under average conditions at the power rate will be greater than fuel directly burned. But there are compensating advantages gained which more than offset the additional cost. This has been abundantly proved in actual practice. The saving of attendance, and of time, freedom from dirt, coolness of the kitchen, absolute uniformity of heat and ability to regulate it, appeal at once to the householder. There is merit aside from novelty in such practice.

In industrial work wherever flames are used to secure localized heat, electricity can be advantageously employed. It is more easily regulated than flame, there are no unhealthy products of combustion, the mean temperature of the shop is lowered, the temperatures are constant, the work is more uniform and the entire system cleaner and more complete. For factory use it is the most desirable form of fuel. In laundries, clothing manufactories, hat factories, silk and all textile fabric mills, shirt factories, rubber goods manufactories, furniture factories, etc., are good fields for the use of electricity for heating. In domestic life no source of heat offers so many elements of value as the use of electricity for cooking and laundry work. There is no discomfort, no noxious gases from combustion, and the temperatures attained are constant, so that the question of the discretion of the cook is eliminated and better results obtained than can possibly be reached from the approximate temperatures of surfaces heated by combustion. It may be fairly stated that people who could afford to do their lighting by electricity could afford to do their cooking and ironing by the same means.

Electricity for heating will be found of the same value to central station electric lighting companies as the use of gas for fuel purposes has proved to the gas lighting companies. Its value lies largely in ability to localize the heat, and it will not be found desirable to use it on a large scale where diffused heat is wanted. High temperatures and small quantities are the proper uses for electricity for fuel.

THE body of James Lick, the founder of the Lick Observatory, is buried under the great 36 inch equatorial. On an old oaken work bench is a German silver plate engraved, "This work bench was brought from South America to San Francisco in 1847 by James Lick—the foundation of his large fortune and the source of his power to confer great and lasting benefits upon his fellow citizens and mankind was honest and faithful labor."

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Improved Steam Pipes.

To obviate the risks of careless brazing, and enable the thickness of sheet copper forming the pipe to be reduced to a minimum, at the same time that full advantage of wire winding is secured, a patented system of manufacturing steam pipes is at the present time being experimented with by a West of Scotland firm. It forms even a closer analogy to the wire gun than the present system of wire winding, and consists in using copper of the thinnest practical gauge, to form the interior or core of the pipe, the body of the pipe proper being composed of steel wire wound closely round the core, and the interstices between the coils being filled in solid with copper by a patented system of copper electro-deposition. Pending this and other possible improvements on copper pipes, one result of past experience with these is to give an impetus to the use of lap-welded wrought iron pipes. In the new Cunard steamers, Campania and Lucania, the main steam pipes are of this type, and experience with these so far bears out the contention of some engineers, that for modern high pressures they are, on the whole, the best that can be used.

TO SET FIRE TO A PILE OF SNOW.

When you go out in winter while there is snow on the ground, says *La Science en Famille* to its boy readers, do not forget to put a few bits of camphor in your pocket. They will prove useful to you for playing an innocent little trick that will surprise your companions, whom you have previously told that you are going to set a pile of snow on fire.

SETTING FIRE TO A PILE OF SNOW.

After gathering a small quantity of snow and arranging it in a conical pile, place in the summit of it the few pieces of camphor in question, the color of which will sufficiently conceal them, and which will pass unperceived unless a very close-by observation is made.

Now apply a lighted match to the camphor and the latter will immediately take fire and burn with a beautiful flame, to the great surprise of spectators who are not in the secret.

The Colossal Passenger.

An account is given in the *Daily Telegraph* of a cattle dealer from the department of the Seine et Marne, a phenomenally stout man, who had driven into Paris, and as his horse was taken ill during his stay in the metropolis, resolved to leave the animal and return home by rail. He bought a ticket at the Vincennes station, but all his efforts to effect an entrance into a compartment proved abortive. The company's employes went to his assistance, and he was pushed and squeezed, almost denuded of his garments, but all to no purpose. The train was soon to start, and the scene had been watched with no little amusement by a number of passengers. "Well," said the cattle dealer to the station master, "the regulations have not settled the dimensions of the travelers. I have my ticket and you must take me." The distracted official now proposed that the colossal passenger should make the journey in a luggage van. The offer was accepted and soon afterward the train was speeding on its way with the cattle dealer seated on a big box in the van, which had been covered for his special behoof with a comfortable cushion.

PROF. ZUNTZ has made experiments with a Pettenkofer respiration apparatus at Gottingen, on the respiration by the skin and intestine of the horse. He first of all found that the total output of carbon dioxide in twenty-four hours was 4,200 grm. Excluding that from the lungs, the remainder due to the skin and intestine amounted together to 145 grm., and an additional 22 grm. from volatile hydrocarbons. The latter can only be methane, and hence come from the intestine. Now since the gases of the intestine have a constant composition as regards methane, carbon dioxide and hydrogen, it became at once possible to calculate how much carbon dioxide comes from the skin and how much from the intestine.

Lightning Photography.

An ingenious method of photographing the spectrum of lightning is proposed, says *Nature*, in the current number of *Wiedemann's Annalen*, by G. Meyer. The difficulty of directing the slit of the spectroscope upon the flash is got over by substituting a diffraction grating for the prism. A grating ruled on glass is placed in front of the object glass of the apparatus, the object glass being focused for infinite distances. Under these circumstances several images of the flash are obtained, a central image produced by the undiffracted rays, and images of the first and higher orders belonging to the diffraction spectra. The number of images of each order corresponds to the number of lines in the spectrum of the lightning. The arrangement was tested during a night thunderstorm. Two plates were exposed in a camera with a landscape lens of 10 cm. focal length, provided with a grating with 40 lines to the mm. One of the plates showed two flashes with their diffraction images of the first order, but representing one line only. The other showed a number of flashes, and one very strong one, passing apparently between two chimney pots, with its diffraction images well marked. A calculation of the wave length of the light producing these images gave 382 $\mu\mu$. The measurement was not sufficiently accurate to warrant an identification of this line with a known wave length, but it is certain that a radiation of about this wave length must be added to the lines determined by Schuster and Vogel. It is probable that with better apparatus the method may be made to considerably increase our knowledge of the ultra-violet spectrum of lightning.

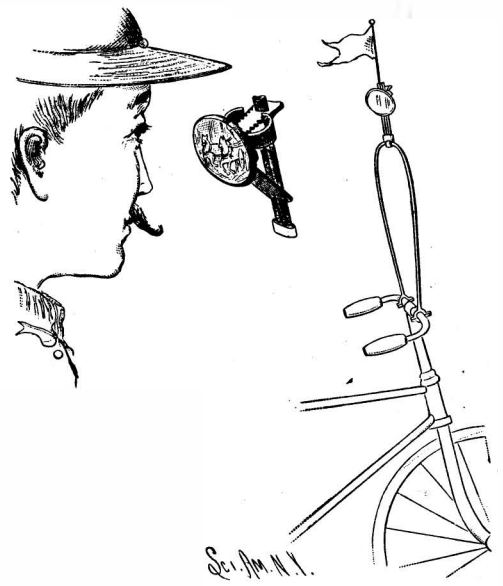
NEW PIER FOR THE AMERICAN LINE.

The recently completed pier for the American Line steamers Paris and New York, sailing between New York and Southampton, shown in our illustration, is said to be the most perfectly equipped as well as the largest pier in this country. It is on the west side of the city, between Dey and Vesey Streets, and extends 720 feet into the river, with a uniform width of 125 feet. It has been leased from the city for ten years at an annual rental of $50,000, and the company has built upon it an enormous two-storied "shed," so called—a masterpiece of light but solid iron work—for the convenience of passengers and the handling of freight. The building is the full width of the pier and extends to within 125 feet of the river end. The second floor will be wholly given up to cabin passengers, who will reach it directly from the main decks of the steamers and avoid the nuisance and discomfort of being indiscriminately mixed up with baggage, freight, cabs, trucks, etc. At the eastern end is the grand stairway, leading by low, wide steps from the floor below, and a passenger elevator. Here, also, are the waiting rooms and offices, finished in hard natural wood and fitted with all the modern conveniences that one sees in well appointed railway depots. The lower floor, at the street level, is given over to freight and the offices of the shipping department. The whole cost of the building and fixtures is over $300,000. It has a Sturtevant hot blast apparatus for heating and ventilating the offices, and the electric plant comprises two dynamos of 400 sixteen candle power lamps each and two 50 arc light dynamos.

For our illustration we are indebted to the *Electrical Engineer*, New York.

A MIRROR ATTACHMENT FOR BICYCLES.

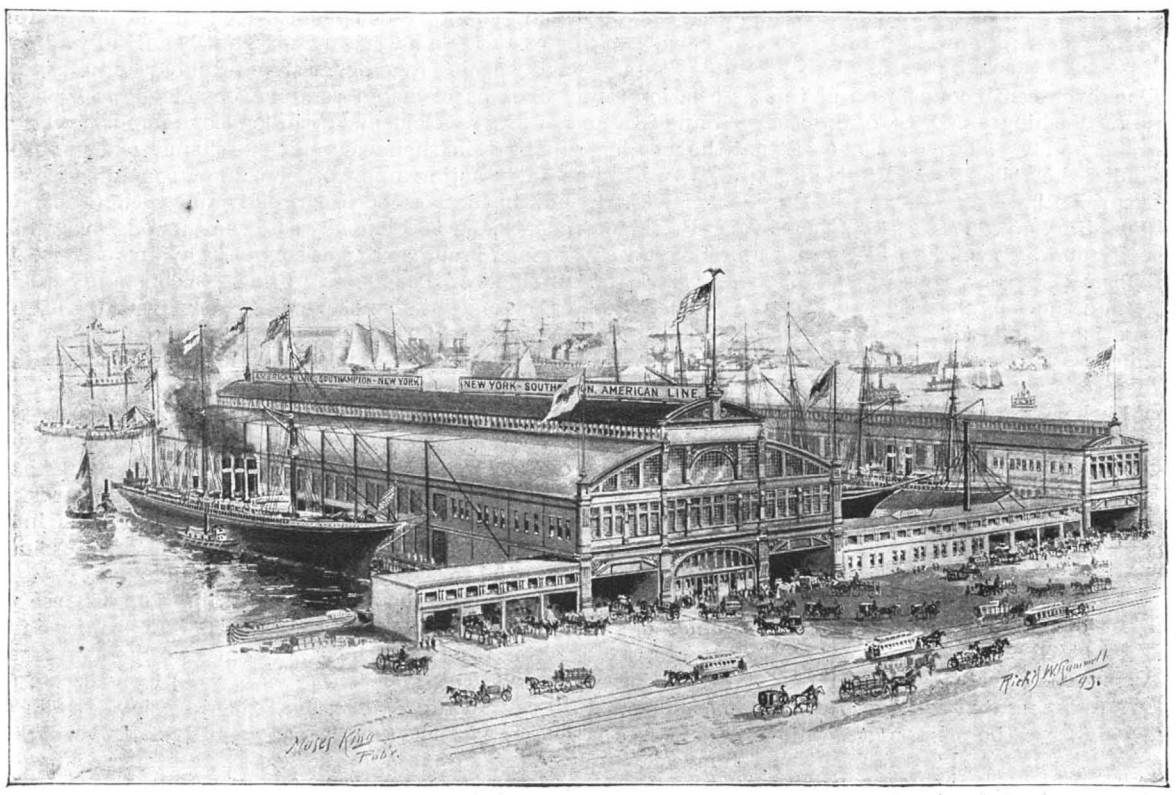
A device to enable bicycle riders to observe vehicles, etc., approaching from the rear, without being obliged to turn and look back, is shown in the accompanying illustration, and has been patented by Mr. K. F. Bucherer, No. 411 East Ninth Street, New York City. The attachment consists of a yoke-shape or arch bar fastened onto the handle bar of the bicycle by means of two clamps, and supporting a mirror, which is hinged to a V shaped keeper, so that it can be moved up or down the standard bar by pressing the two ends of the keeper together, and releasing at the desired height. The mirror itself may be placed at the inclination desired for distance or nearby observation by simply pressing it in the desired position, where it will be held by pawls catching into the toothed keeper. The adjusting of the mirror to the proper place can be done with one hand only while riding. All the parts of this bicycle attachment are very simple and not liable to get out of order.



BUCHERER'S BICYCLE MIRROR.

The Geologic Age of the World.

Prof. C. D. Walcott expresses the opinion—contrary to that entertained by some scientists—that geologic time is not to be measured by hundreds of millions of years, but simply by tens of millions. This is widely different from the conclusion arrived at by Sir Charles Lyell, who, basing his estimate on modifications of certain specimens of marine life, assigned two hundred and forty millions of years as the required geologic period; Darwin claimed two hundred million years; Crowell, about seventy-two millions; Geikie, from seventy-three million upward; Alexander Winchell, but three million; while McGee, Upham, and other recent authorities claim from one hundred million up to six hundred and eighty million. The data presented by Dr. Walcott, showing the distribution of geologic time, or the different periods of sedimentary rocks, give two million nine hundred thousand years for the cenozoic and pleistocene, seven million two hundred and forty thousand for the mesozoic, seventeen million five hundred thousand for the paleozoic, and a like period to the latter for the algonkian—a total of forty-five million five hundred thousand years.



THE FINE NEW PIER FOR THE AMERICAN LINE STEAMERS PARIS AND NEW YORK.

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THE TACHOCYCLE.

For a full-grown man or woman to roll a hoop would seem very puerile, and yet a glance at the accompanying reproductions of photographs taken at Dieppe last summer might make a person think that the sport therein represented, which is now much in favor, and which, although less primitive than hoop rolling, is just as useful for restoring one's impaired health, was carrying him back to the days of his childhood. It is a question of an apparatus designed, through the pull that it exerts in moving forward, to increase the speed of a person walking or running a foot race. It consists essentially of two wheels of any sort of material utilizable for the purpose, and to which any desired dimensions may be given. These wheels revolve freely around an axle that serves as a support, and upon which a person bears through the intermedium of handles. In the apparatus shown in Fig. 3, the axle is straight and is provided with two handles, but in Fig. 4 it is cranked so as to permit of the foot resting upon it. The wheels, too, might be made fast to the axle and the handles be rendered loose upon the latter. The inventor even proposes to add small intermediate wheels, if need be, to give more stability to the entire system. As may be seen, the mechanism is not very complicated. In this respect, the apparatus seems to have a great advantage over ordinary cycling machines, which are so quick to deteriorate; and, although the speed at which it carries a person along is not so great as that of such machines, it nevertheless seems as if its utility were greater, from a hygienic standpoint, since walking or foot racing will always remain the kind of locomotion best adapted to our physical nature, without speaking of the accidents that are less to be feared with this apparatus, which one can let go of at any moment, if occasion requires it. Figs. 1 and 2 are some models of the apparatus put in service last summer at Dieppe, where the bathers gave them a most favorable reception.

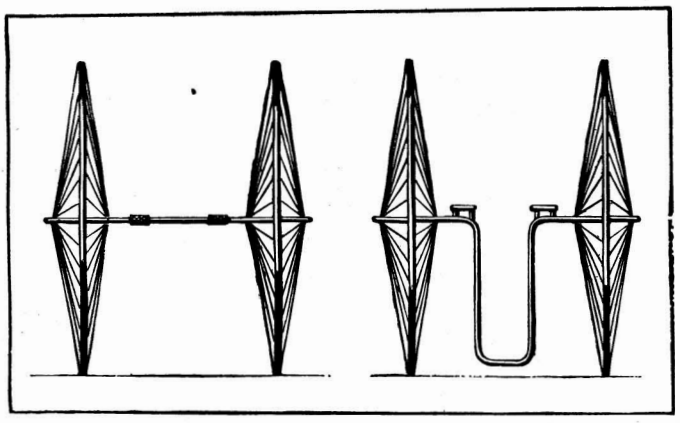


Fig. 3.—Tachocycle with a Straight Axle.

Fig. 4.—The same with a Cranked Axle to serve as a Foot Rest.

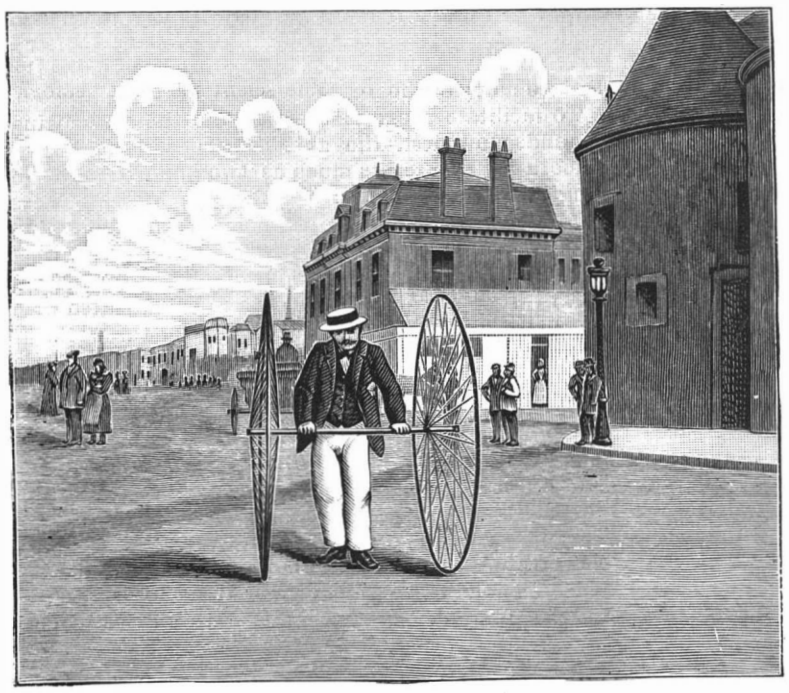


Fig. 1. THE TACHOCYCLE ON THE BEACH AT DIEPPE.

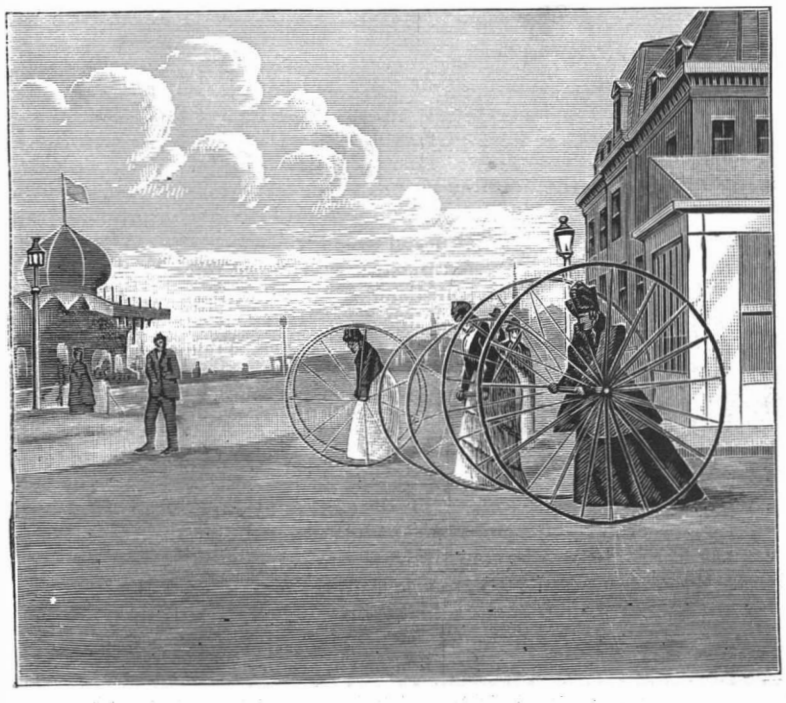


Fig. 2.—THE TACHOCYCLE ON THE BEACH AT DIEPPE.

HINTS ON COLORING LANTERN SLIDES.

BY GEO. M. HOPKINS.

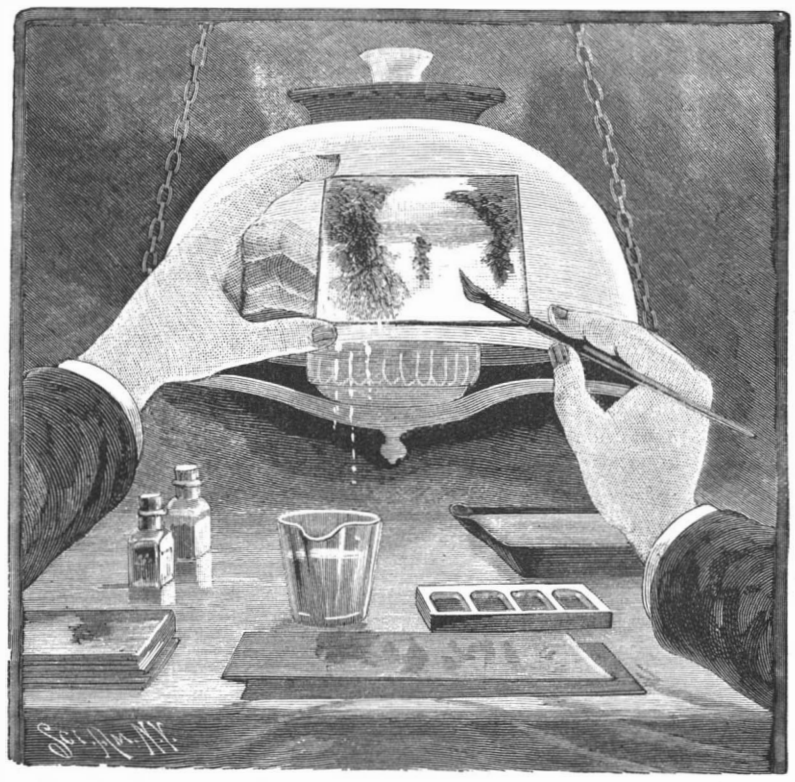
It frequently happens that one who is practiced in the art of coloring lantern slides desires to color a rare or valuable slide when the remotest chance of injury to the slide cannot be taken. In such cases the color must be applied either to the back or outer surface of the plate or to a plate that will answer the purpose of a cover glass. The latter method is certainly to be preferred, as it involves no risk whatever, and at the same time affords an opportunity of trying different color effects on the same picture; such, for example, as spring, summer and autumn tints in landscapes, and different combinations of color in architectural views, interiors or figures.

The plate used for receiving the color is an old unused gelatin lantern slide plate, from the film of which the silver has been removed by hypo; or a gelatin plate from which a discarded view has been removed from the film by means of a reducing solution; the plate in either case being washed long enough to remove all hypo.

The film on the unused plate will need toughening by soaking it for two or three minutes in a solution of alum of the strength commonly used for preventing frilling, the plate being afterward thoroughly washed. This plate takes color better than one which has been subjected to the reducing process. A plate may also be prepared by flowing a solution of gelatin over a clean cover glass, allowing it to dry, and then treating it to an alum bath and subsequent washing.

The slide to be colored, which is, of course, unmounted, is placed with its glass side against the glass side of the transparent film-bearing plate, which is dry, and the transparent film is wet all over by means of a very soft brush carrying clean water. Some caution is required to prevent the film side of the slide from becoming wet. A small quantity of water absorbed between the contacting glass surfaces is an advantage, as it binds the plates together and prevents them from moving easily one on the other.

The coloring is done upon the transparent film, following the outlines and every feature of the picture as closely as possible. It will, of course, be impossible to follow every leaf and blade of grass, or every twig and flower, with perfect accuracy, on account of two thicknesses of glass intervening between the color film and the picture film, yet the results secured by this method are astonishing. The writer has colored slides in this way which were not distinguishable, even by experts, from slides colored on the picture-bearing film. The following description of a method of coloring prints on gelatin-coated lantern slide plates is taken from the writer's article in the SCIENTIFIC AMERICAN of March 11, 1893, it being applicable in the present case:



LANTERN SLIDE COLORING.

The first operation in coloring is to go over the entire surface of the film while it is wet with a thin wash of warm color, which may be either yellow or pink, depending upon the subject. This kills the chalky whiteness of the high lights, and gives the entire picture a warm and desirable tone, even though the wash is not sufficiently strong to be detected when the picture is thrown upon the screen.

The colors used for this purpose are transparent aniline colors prepared for coloring photographs. They are labeled brown, blue, violet, flesh, orange, green, and so on. The ordinary aniline dyes may be used instead of the prepared colors, as they are practically the same. The manipulation of the colors is the same as in water color painting. The film is kept wet continually from the beginning to the end of the operation, but after the broad washes of the first warm tint and the final sky color, the water lying on the surface of the film is allowed to dry off, leaving the film still swelled and wet, but without the surface water.

The prepared colors can rarely be applied to the slide without being reduced with water. Sometimes the best effects are produced by mixing different colors before applying them, while in other cases the effects are secured by separate washes of different colors, superposed. Each wash of color sinks into the film and is not removed by a subsequent wash.

Although an easel or support something like a retouching frame may be useful, the writer prefers to hold the slide in the hand, as shown in the engraving. The wet plate is held in a slightly inclined position in front of a lamp provided with a plain opal or ground glass shade. The writer prefers artificial light for coloring, as the pictures are to be shown generally by artificial light, which is yellow. If the pictures are designed for projection by sunlight, it is undoubtedly better to color them in daylight.

The first wash is preferably put on while the slide is held in an inverted position, and while it is still flowing the blue is added for the sky, at first very light near the horizon, increasing in intensity toward the top of the slide. After this wash is set and superfluous water has evaporated, the water accumulating along the lower edge of the plate is removed with the fingers, and the slide is turned right side up, when the extreme distance, whether it be mountain or foliage, is covered with a light wash of blue, and this wash is brought well down toward the foreground. If the blue appears cold, it can be toned down by a very light wash of yellow or red. Trees in the middle distance can now be gone over with a light wash of orange or orange with a little of the flesh color or pink added. When near the foreground a very light wash of green is applied to the foliage, but the raw green of the color set cannot be used for this; it must be modified by the addition of orange or of brown. If when applied the green appears too cold, it may be toned down by a light wash of brown, of orange or flesh color. It is desirable to produce variety in the foliage.

Rocks in the distance are washed with blue and the color is subsequently modified by washes of red or brown. Trunks of distant trees and some rocks may be left nearly the original color of the photo., but near rocks and tree trunks may be tinted with brown, blue,

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or warm green, and subsequently modified by washes of green, red, brown, yellow, or orange.

It is useless to trace the smaller branches of trees and shrubs, and it is rarely necessary to deal with single leaves or blossoms; when this must be done a jeweler's eye glass is required, and fine, small brushes are used, great care being taken to keep within the outline of the object being colored. In all this work, the artist does well to remember that the coloring is to stand the test of great magnification and strong light.

The plate is apt to dry out in some places while the coloring is going on at other places. As coloring cannot be successfully done on a dry surface, it is important to wet the surface before proceeding. This is done by applying water with a soft camel's hair brush. After the surface water has disappeared the coloring may proceed.

It is obviously impossible to mention every modification of color that may be produced by mixtures and washes. This is something to be acquired by practice. The writer uses very few colors, rarely more than the following: Blue, green, brown, orange, flesh, rose, and yellow. The last is a strong color which must be applied with caution. Green and blue are also strong colors which can never be applied without the admixture of a warm color, or a subsequent wash of the same. Brown in different strengths has a large application. It is useful in toning down bright greens, for rocks, tree trunks, earth, etc. A wash of blue over the brown produces a different but useful gray.

The principal points to be observed are to keep the plate always wet, to use light washes, to modify color by subsequent washes, and in working up details to preserve the outlines.

After the coloring is completed, the glasses are separated, the colored film is allowed to dry, when it is placed over the picture, the two films being in contact, and a binding strip is attached to the edges in the usual way. The mat in this case is pasted on the outside of the cover.

When it is desired to color a wet plate or collodion film slide with liquid colors, the collodion film is coated with a thin transparent film of gelatin, which is allowed to dry, when it is immersed for a few minutes in a solution of alum, to toughen it. It is then washed, and while still wet, the broad washes of color are applied.

Something has been said about the permanence of the liquid colors used on the slides. The writer has many slides colored in this manner two or three years since, which have not changed perceptibly. Without doubt continual exposure to sunlight would affect them, but it would also change any other colors used for this purpose. In a prolonged test in sunlight of all the liquid colors used on slides, it was found that the greens after a time turn yellow. Brown becomes somewhat darker. The reds and yellow remained unchanged. Blue faded slightly. But this is a test more severe than colored lantern slides would ever be subjected to. The writer believes they would retain their color indefinitely.

A Substitute for the Buffalo Robe.

The disappearance of the buffalo has led to a useful invention and a new industry. The American Buffalo Robe Company, 1 to 7 Howell Street, Buffalo, N. Y., is manufacturing the Saskatchewan Buffalo Robe, which is such an excellent imitation of the original that they can hardly be told apart except on close examination.

This robe is the invention of Mr. A. M. Newlands, of Galt, Canada, who has had 30 years' experience as a woolen manufacturer, and he foresaw, along in the seventies, when the buffalo disappeared, never to return, that a substitute must be had for its valuable skin.

The Saskatchewan is made on a patented machine. A back as strong as leather, with a covering of hair and wool, made in one piece (no seams to rip), and lined with a scarlet or black lambskin, and an intermediate lining of rubber sheeting, which makes it impervious to rain and wind.

Doctors, liverymen and farmers, who have tested these robes for four years in Canada, pronounce them equal in all respects to the old buffalo, which, for a century or more, did such good service when wear and warmth were a necessity.

At the World's Fair, Chicago, these robes, also coats made from the same material, were on exhibition. They attracted much attention, and received the highest award and a diploma.

The Boynton Bicycle Railroad.

An exhibition was given of the Boynton bicycle railroad between Hagerman Station and the Great South Bay, at Bellport, L. I., on the 16th of February, which was witnessed by twenty-seven members of the Massachusetts Legislature, including the members of the Senate Transit Committee, the Senate Committee on Street Railways and the House Committee on Transit. In addition to the above there were about one hundred prominent railroad men from different parts of the United States, as well as a large press representation. They were entertained by Mr. Dunton, a nephew of Austin Corbin, who is president of the company, and by Mr. Boynton, the inventor. The system was illustrated in the SCIENTIFIC AMERICAN of February 17, 1894. The road is two miles long, but in that short distance a speed of over fifty miles an hour was obtained. Mr. Boynton explained the details to those present, and Mr. Dunton delivered an address, pointing out the commercial features.

Air and Life.

All living creatures breathe, and the air is as necessary to them as water, food, and a certain amount of heat. From the chemical point of view the air is composed of different elements. It is not at all a simple body, as was supposed up to the end of the last century, but a mixture of gaseous bodies, capable of being isolated and analyzed. Among these elements three preponderate in quantity and physiological importance. These are oxygen, azote, and carbonic acid. Oxygen and azote constitute the greatest part of the air—the essential part. The most important of the accessory elements is carbonic acid, being found in the air in the proportion of four or five parts to every ten thousand parts, varying according to locality. There are, besides, other bodies which enter into the composition of the atmosphere, as ammonia, azotic acid (found in rain water), and ozone, an oxygen condensed in some way under the influence of atmospheric electricity. These, however, exist only in very small quantities.

Every one knows that without oxygen there would be no life, either of plants or animals. Paul Bert, however, has found by experiment a fact which, at first sight, seems very strange. This is, that oxygen, this gas, vital above all others, is a violent poison, for the plant as for the animal, for the cellule as for the complete organism; and, if found in the air in certain proportions, immediately becomes an instrument of death. This is one of the most curious of recent discoveries. No oxygen, no life; too much oxygen, equally no life. We now pass to azote. If an animal or plant is placed in this atmosphere, death takes place without delay. It is not that azote is a poison, but it is inert, useless, and incombustible. Its respiratory role is valueless, and its only function seems to be that of tempering the action of the oxygen.

We come now to carbonic acid. This, as we know, is a very noxious element; injurious to animals and to plants, it appears as a gas injurious above all others. Nevertheless, it is one of the essential bases of life. If it disappears from the air, vegetation is immediately destroyed, and in its absence but a few days would elapse before all that breathes would disappear from our globe. In certain cases, however, the atmosphere itself is an instrument of death, containing, as it does, the different microbes. Some of these are inoffensive, but many are deadly. Spread through the air by persons afflicted with tuberculosis, varioloid, scarlatina, diphtheria, every species of microbian disease, they travel far and wide, scattering death in their train.

Thus we see that the atmosphere brings life and death at once. Each of its elements is indispensable to life and each of them is an agent of death, according to conditions and proportions. The one which seems to be most vivifying can become a formidable poison; the most useless, the most noxious even, is shown by analysis to be an essential base of life. And the conclusion is, that if any one of these should disappear, the earth would immediately become a naked and barren globe, deprived of all life. Looking at this still further, another fact is revealed to us. It is that, according to the very happy expression of J. B. Dumas, all living creatures are only condensed air. Vegetables exist only by virtue of the air, animals by means of the vegetables. The elements of vegetable life are those of the air, and animals live on the vegetables. The connection is narrow, intimate, direct. Man is condensed air. And as this air, during the centuries that man has existed, has incessantly traversed through bodies of our ancestors, being part of them for a time, and then again disengaged, our body is actually made up of the same elements as that of our ancestors. The substance is the same. And that substance, which is also that of the vegetables of the past, circulates ceaselessly through space. To-day or to-morrow, flower or fruit, it will incorporate itself, here, in the slow growth of a mollusk; there, in the brain of a Descartes, a Pascal, a Joan of Arc, a Shakespeare. It never stops; its cycle, of which no human eye has seen the beginning, and of which none will be able to observe the end, seems infinite; passing alternately from life to death. Old as the world, and in spite of that, eternally young, it would appear (if it had consciousness) to have exhausted all that life contains of joy and of sorrow, and to have known all the emotions, the most noble as the most vile.

That air which so sweetly blows in our face to-day is all past existence; it is a myriad of existences, those of our ancestors, those also of the dead for whom we mourn; to-day it becomes a part of us, and to-morrow it will pursue its journey, metamorphosing itself without cessation; passing from one organism to the other, without choice, without distinction, until the day when, our planet dying, all this substance will re-enter into the frozen earth, a gigantic tomb which will revolve silent and desolate, through the unfathomable depths of the universe. And after? Science remains dumb. In that book of nature which opens to us and in which we plunge with avidity, in order to decipher the future, two pages are wanting, those which would most interest us: the first and the last.—*Public Opinion, from Revue des Deux Mondes.*

Industrious Texas Ants.

Last summer, I believe it was, writes a contributor to the Galveston *News*, while lying in the shade of a large pecan tree, I noticed a small family of aphides on the leaf of a cotton stalk, and was not a little surprised a moment later on seeing a large red ant with black head and long legs emerge from the under side of the leaf. I soon recognized him as one of the well known pastoral ants (*Hypoclines*), industrially the lowest of the ant family, and who lead a lonely life, like the old Syriac shepherds tending their pygmy cows. On the same leaf I noticed a fellow herder, who was tending a still smaller flock. Both went about from time to time, and gently stroking with their antennæ the tube-like protuberances on the abdomen, induced a slight flow of sweet liquor, the honey dew of the apir. These crystal beads of honey they dexterously licked off before they fell on the leaf, and quickly hurried away to repeat the same operation on another aphide.

The sagacity of the shepherd ant is only rivaled by that of the farmer ant, also a native of far Western Texas. These remarkable insects, according to some writers, plant each year a crop of ant rice, a cereal seemingly originated by some farmer agriculturist in bygone ages, and when the crop is ripe they gather it into subterranean granaries, always reserving a store for planting.

Somewhat resembling in occupation the farmer ant, Texas can boast of many colonies of the umbrella or leaf-cutting ant, so common and destructive in Mexico and Central America. In the latter countries they are quite destructive, often destroying large trees, and their depredations have to be guarded against by means of woolen fillets wound about the trunks of the trees. Many notions, wholly without foundation, seem to be current concerning these strange little pests. Their method of operation, so far as I have observed in Fort Bend County, is to strip only the smaller trees and shrubs. The leaves are not cut into disk-shaped pieces, as commonly supposed, but in any form that suits the artistic fancy of the ant.

To facilitate progress to and from the leaf-cutting grounds and nest, the ants construct clear, broad, smooth roads, often as much as two hundred yards in length and from six to eight inches broad. These roads display considerable engineering skill, abounding in curves, grades, and even tunnels. The leaf-cutters seem to be the most industrious of all the ant family; big, little, old, and young seeming to be animated with an almost insane desire to do his share of the work.

Nothing could be more amusing than to see a little fellow, not more than the fourth of an inch long, hurrying madly along with a huge leaf dexterously held in his mandibles. The nest of the umbrella ant is a very poor affair, and bears about the same relation to the neat tunnels of the farmer ant that the hovel of the squatter does to the substantial home of the prosperous farmer. Any rude hole or hollow log serves the leaf gatherer as a store room, where he puts away his hot bed to hatch out the eggs deposited by the female. The leaf-cutter is thus the original inventor of the incubator, although his rights have never been recognized by letters patent.

In New Mexico and Northern Mexico is to be found the honey ant, sold as confections by the Mexicans, which are eaten something like grapes. Unlike the bee, the ant is unable to secrete wax or otherwise make a suitable receptacle for his gathered honey, but in the face of these difficulties he has solved the problem completely. Certain members, very patriotic ones, doubtless, are selected who act as honey jars or workers. These martyrs stay at home and bravely swallow the gathered honey until their gradually extending abdomens will hold no more, and as they hang suspended like so many golden drops from the sides of the tunnel, they have the appearance, though not the sentiments, of bloated capitalists profiting in idleness by the labors of their fellow beings.

The life of the honey keeper is no sinecure. His duties are arduous and require the greatest care. When the honey season is over he it is who feeds the idle hands, regurgitating a drop of honey whenever a check on the larder is presented, the latter consisting of certain well defined strokes on the head and body by the hungry ant. Some malignant investigators, whose whole desire seems to be to fasten on these exemplary little animals the vices of men, claim that there is to be found a parasitic bug in the nests of the honey ant which, at the solicitation of thirsty members, yields an alcoholic liquor something similar to beer. The methods of the formic topers are said to be similar to those of the enlightened Caucasian, consisting in certain winks and expressive crookings of the elbows.

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Correspondence.

How to Silver Glass.

To the Editor of the Scientific American:

I have frequently noticed in the SCIENTIFIC AMERICAN, and also some of the SUPPLEMENTS, under the heading "Silvering Glass," various silvering solutions, such as are used in the plating of mirrors, and as I have tried each one of them myself and attained results far from satisfactory, I beg to send herewith formula for a silvering solution which contains only a small percentage of silver compared with others which I have unsuccessfully tried, and which will invariably produce excellent mirrors, provided the following conditions are adhered to:

1. Pure chemicals.
2. Have the glass chemically clean.
3. Adhere strictly to the formula.

And I trust that other readers of the SCIENTIFIC AMERICAN who have been endeavoring to silver glass with the other solutions heretofore given will advise you of the superiority of the following:

1. Solution.—Dissolve 2½ drachms nitrate of silver (crystals) in 2 ounces of water, and add concentrated liquid ammonia, drop by drop, until the brown precipitate formed is nearly, but not quite, all dissolved; then add 24 ounces water, and filter three times.

2. Reducing Solution.—Dissolve 1½ drachms nitrate silver in 24 ounces of water; then take 1 ounce of water in a graduate and dissolve in it 30 grains white caustic potash, and add this to the 24 ounces of solution just mentioned; then add 420 grains Rochelle salts. Filter three times.

Note.—Solution No. 2 will be found to have a heavy black precipitate, and it is necessary to filter same until it is perfectly clear, which can be accomplished by having three funnels one above another, with filtering cotton packed in rather tightly.

Use distilled water.

To use the above solutions, mix equal parts of No. 1 and No. 2 together, and flow over the glass, which, however, must be in a room heated to about 90 or 100 degrees F. Yours truly, JOHN BREFFITT.

No. 407 Sherman Street, Wilmington, Del.

[We have tested the formula printed above and find that it gives excellent results. Two parts of No. 1 to one part of No. 2 by measure gave better results than equal parts. The glass should be cleaned with caustic potash dissolved in water and should be thoroughly rinsed before silvering. The process of silvering can be hastened by having a steam table on which to lay the plate of glass over which the combined solutions have been poured. A gas stove or an oven may be used. Small pieces of glass can be silvered in one to two minutes by holding them a few inches above the flame of a Bunsen burner. Defective spots may be remedied by removing the silvering around the spot with nitric acid and resilvering. If the hands become stained with the solution, rub the stains with a crystal of resublimed iodine until the color begins to change, then sponge with alcohol. Only small pieces of glass should be attempted at first until the method of working the process is well understood.—Ed. S. A.]

Concerning a Change of Policy in the Administration of the Patent Office.

BY PHILIP MAURO.*

The views presented in these pages were called forth by the announcement of a rumor that the present Commissioner of Patents had decided to inaugurate a decided change of policy in his office, in the treatment of applications for patents where the margin of novelty is small or the exercise of invention doubtful. The old rule, unwritten but tacitly recognized, has been: When a substantial doubt exists, to give the applicant the benefit of it. This rule, it is said, has been reversed.

The particular point of inquiry is, whether the examining corps of the Patent Office has been so lavish, lax and imprudent in the issue of patents, particularly where the novel improvement sought to be covered was of a trifling character, that the public interests have been detrimentally affected. If so, what are the particular evils that have resulted from this undue liberality, and how far should the Patent Office shift its ground in the other direction in order to avoid them?

In so large a body of men as the examining corps there is, of course, great diversity of character, disposition and mode of action. In the exercise of judgment upon applications for patents, we find the two extremes of undue liberality on the one hand and excessive strictness on the other, and this will always be so; but no one competent to judge will deny that, up to the present time, the work of the bureau as a whole has been characterized by fairness, just discrimination and due appreciation of the rights of inventors, with a leaning rather in the direction of the more illiberal and narrow decisions which have in recent years emanated from judges of small experience in patent matters and of slight acquaintance with the actual steps of the process whereby the development of the useful arts is effected.

Unless the actions of the examining corps as a whole have been lax, careless and unduly liberal (which certainly is not the case), it is clear that the sum of all the effects of a change in the direction of greater stringency must be detrimental and injurious. The easy-going and indulgent examiner (how many such are there?) may be restrained from improvident grants, but the man of fair mind and sound judgment will feel impelled to refuse patents which, in the untrammeled exercise of his discretion, he would ordinarily allow; while the strict constructionist, whose dominant motive appears to be hostility to inventors, will be confirmed and encouraged in his disposition to perceive an antagonist in every applicant for a patent, and to dispute and place obstacles in the way of every claim that is submitted for allowance.

The proposition at this point is simply that the policy of the Patent Office as a whole in the treatment of applications has not heretofore been liberal to the point of laxity or improvidence. The only basis that I am aware of for any opinion to the contrary is the fact that many patents have been held by the courts to be void or illegal grants, on the ground that the subject matter was not patentable, or did not, in view of the evidence and character of the results achieved, rise to the dignity of an invention, or involved merely the exercise of mechanical skill.

But admitting the full force of the fact that certain examiners, in certain instances, have erred on the side of excess of liberality, what are the consequent evils as compared with those of errors in the other direction? The grant of a patent is, in ninety-nine cases out of a hundred, an act without any consequences whatever. But so potent for good is the hundredth invention—the one that contains the germ of vitality and usefulness—to such an extent does it stimulate the exertions of other inventors, that it more than pays for all the failures. The chances, then, of issuing one patent too many are infinitely small as compared with the chances of prematurely stifling and suppressing what might be productive of benefit; so the greatest care in conducting the work of the Patent Office is needed to guard against actions which both work injustice to meritorious inventors and at the same time injure the public by depriving them of the advantage which inevitably accrues from the grant of a patent for a useful novelty, however trivial.

As to the ultimate career of an invention, the judgment of the most experienced persons is ordinarily worthless. Frequently it is the things that promised least from which the best results have followed, and *vice versa.* It appears strange at first, and yet entirely explicable upon reflection, that the novelties which contain the greatest amount of "invention" and ingenuity are often of the least practical benefit. Machines which are marvelous products of inventive skill, and full of the most intricate and complex mechanism, for which a patent will be granted with enthusiasm, become frequent but curious exhibits of misdirected inventive imagination; while, on the other hand, the inventor who aims to effect but a slight departure or simplification of what already exists is the one who really benefits himself and the community. It is by the accumulation of small changes of this nature that the industrial arts advance, step by step, in ever-increasing usefulness.

It is in partial appreciation and recognition of this fact that the accepted policy of the Patent Office has heretofore been to give the inventor the benefit of the doubt in marginal and doubtful cases. Experience shows this to be the safe and wise policy.

But we have of late heard the reverse of this policy termed "giving the benefit of the doubt to the public." This expression thinly conceals the fallacious idea that in rejecting a patent for a new but slight improvement, it is thereby given to the public. Nothing could be more delusive or contrary to actual experience. It is the grant of the patent, not its refusal, that gives the invention, great or small, to the public; and even the grant is but a step in that direction. After that, it requires the utmost persistence, the most favorable conditions the enlistment of capital and enterprise, to make the blind and heedless public see that the change will be beneficial, and to force the stolid and reluctant public to adopt it. The notion that an improvement comes into possession of the public when the discriminating examiner had decided that it is too trivial for a patent is one that cannot exist in any mind after a most superficial consideration of the facts. The very contrary is the case, namely, that the most effectual way to prevent its ever coming into the possession of the public is to thwart the inventor's efforts to secure a patent for it.

If judges have sometimes differed from the examiners as to what constitutes a patentable invention, I can see in that no reason for hesitation in the granting of patents for fear the courts may find an occasion for such difference of opinion. The chances are that the judges were mistaken in many of these cases; and if they have corrected errors in others, they have simply discharged one of the purposes for which courts are established, and were certainly, with the evidence on both sides before them, in a better position to pass the final judgment than the examiner could be. Let the Patent Office, then, pursue its course courageously, leaving to the courts their proper functions, and not risking, in the attempt to avoid a harmless error, the perpetration of a cruel injustice to the individual and a serious damage to the public.

If we ask where a material injury has been done by an excess of liberality in the decision of an examiner, it would be difficult to find an instance. If we ask in how many cases have patents for meritorious inventions failed because of the persistent and successful efforts of examiners to narrow the terms of the claims, it would be impossible to determine the enormous total.

The catalogue of the reissue decisions contains the history of grievous wrongs and injustice, due in many instances to the inability of the inventor, through lack of means or of competent solicitors, to combat successfully the opposition of an examiner.

The grant of a patent to an applicant for more or other than he can sustain before the courts profits him nothing, and deprives the community of no right. The failure of any inventor, who has communicated to the public his discovery, of whatever magnitude, to secure a grant to the full extent of his right, is occasion for profound concern, against which the officials of the patent bureau should be constantly on the alert.

In making investigations and advising applicants of the results of such investigations, to the end that they may not through ignorance claim things that are really old or already patented to others, and for want of such information be led to difficulties and loss, the Patent Office is performing a magnificent service to the country. For that service it is equipped with facilities and with a trained corps of experts, the like of which exists nowhere else in the world. It is in this respect that our patent system is incomparably superior to any other. To what end are these elaborate investigations made, and for what reason are they beneficial to the public? He who supposes that the main object and beneficial result is to suppress in defense of public interests the issue of patents that could not be sustained, is surely in grievous error. That such is not the case is proved by the workings of the English patent system for over a hundred years, and by the practice of every country of Europe where, with the exception of Germany, patents are granted without any investigation whatever.

Nothing but actual or willful blindness can prevent recognition of the fact that to arrest the grant of a doubtful claim, for fear that the patentee might in some way use it unjustly or mischievously, is the least of all the purposes which the Patent Office is expected to fulfill. No; the object and the merit of the examining system is that it advises inventors of the state of the art, and thus prevents them, not from imposing upon the public, but from deluding and injuring themselves, If, with the results of the examiner's researches before him, and with but a slender margin of novelty remaining, the applicant assumes the risk of a favorable judgment by the courts, and is willing to pay the required fee for a patent of doubtful value, I can conceive of no possible reason why the Commissioner of Patents should interpose objection. So far as I can see, after the best consideration I am able to give to the matter, the only question involved is a fiscal one; and while it would often, in such a case, be a friendly act to the inventor to prevent his paying $20 into the Treasury of the United States, that is surely his affair.

* Abstract of a paper read at the 84th meeting of the American Institute of Electrical Engineers, New York, February 21, 1894.

Plaster of Paris.

The method of testing the quality of plaster of Paris is by taking a small pinch of the powder between the thumb and finger and gently rubbing it; if small particles of grit are felt, it indicates that parts of the plaster have already absorbed water, and it is therefore unfit for use. The same test may be observed by taking a pinch of the powder again and placing the fingers under water, and then rubbing in the same way as before. If, however, in both of these tests no grit is felt, and under water a thin, creamy substance is formed, which is easily rubbed off the fingers, the plaster is in a proper condition for use. Where plaster has been kept for a long time, or where it is gritty, its condition can be very greatly improved. It may be redried by putting it in a metal dish, such as a pie plate or iron pot, and placing in an oven of a hot fire or over a gas jet. As soon as it becomes heated it will be observed that a process identical with boiling water is taking place. When this ebullition has entirely ceased, the powder is freshly kiln-dried. If the method of testing is again resorted to, it will be found that the gritty appearance and feeling will have disappeared, in a very large measure, leaving only the fine, dry powder ready for use. If there are any lumps remaining, they may be removed by the use of a sieve. From what has been already said, it will need be but a reminder that the plaster of Paris must always be kept in a hermetically sealed jar, or in a very dry place.—*Charlotte Medical Journal.*

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THE WADDELL-ENTZ STORAGE BATTERY CAR TRACTION PLANT OF THE SECOND AVENUE RAILROAD COMPANY, NEW YORK.

Very extensive trials have been made in the past in the utilization of storage batteries for street car propulsion. Generally, these batteries have been of the lead plate-sulphuric acid type. In practice it was found that various objections attached to their use—the jarring of the car, and the occasional heavy draughts made upon them for current, both told in the deterioration of the plates; but worse than all was their great weight, the complete battery for a street car weighing so much as, in itself, to be an almost prohibitive feature.

In our present issue we illustrate the works of the Waddell-Entz storage battery traction system, as now in daily use on the Second Avenue line in this city. It is characterized by the adoption of a zinc-copper accumulator as a source of current utilized by a special Gramme ring slow-speed motor. The power station is a most interesting part of the installation, as it represents a systematic set of appliances and a routine method for running the cars subject to its operations.

Of course, the battery is the main feature, and of a cell of this battery we give an illustration, showing its interior construction. The cell proper is of steel 4⅜ inches by 7½ inches area and 11¾ inches high. The joints are soldered with a special solder. The surface of the cell forms a portion of the negative element, the rest being formed by a series of steel plates dropped into it. Between the steel plates and between the outer steel plates and the case is the positive element. This is built up, in general terms, as follows:

Around a wire of copper, copper oxide is compressed; over this is woven a covering of very fine copper wire, and over this a cotton braid. The structure thus produced is similar in appearance to a heavily insulated wire conductor wound in a species of flat spiral, round and round itself, so as to produce what is virtually an oblong plate. To "form" the plate the copper oxide is reduced to the metallic state. One of these plates goes between each of the intervals between the steel surfaces. To preserve the distance uniform a distance braid is attached to both sides of the copper outside element. These features and the general connection of the steel plates in parallel with each other and of the positive or "wire" plates, also in parallel with each other, are shown distinctly in the cut.

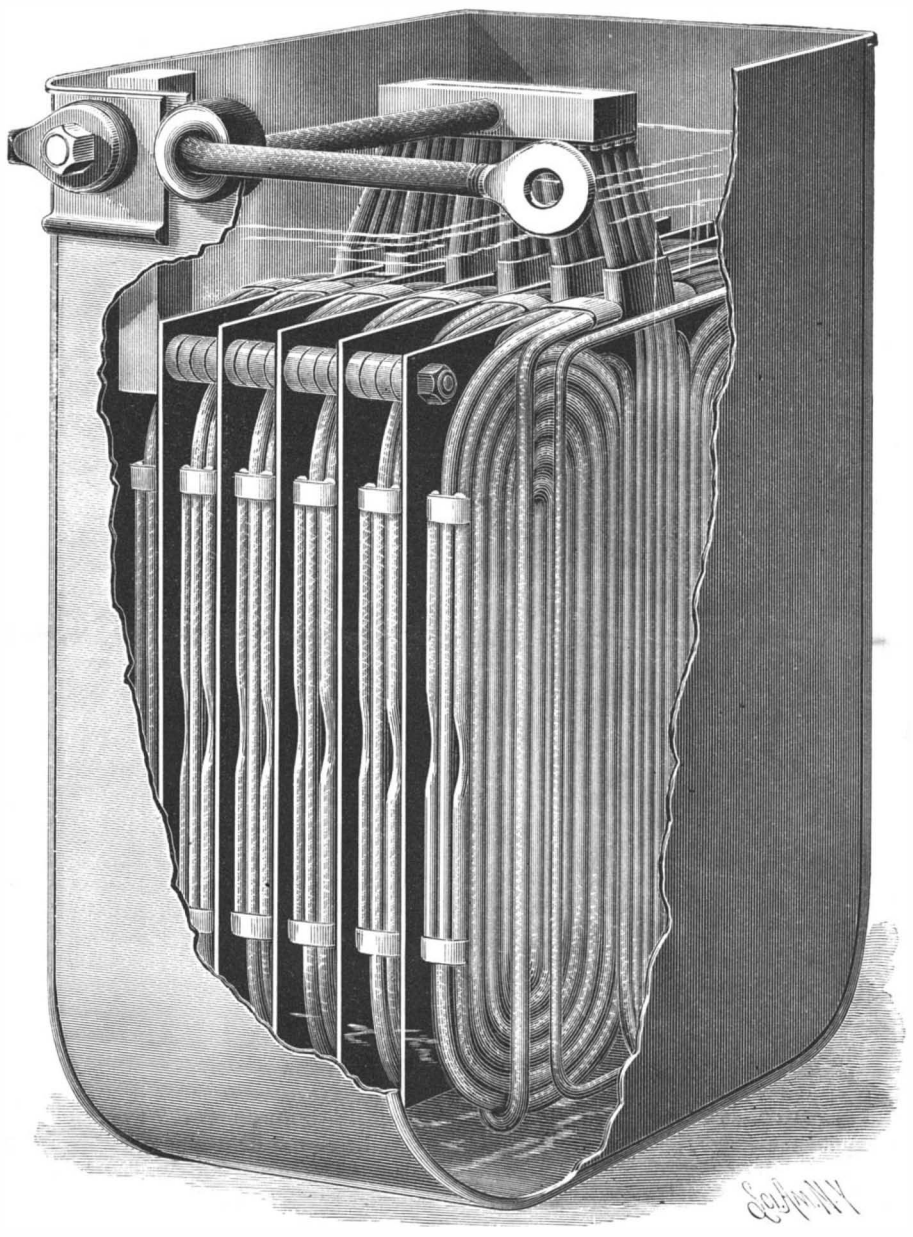
The solution for these batteries is made by dissolving zinc oxide in caustic potash, to a specific gravity of 1·45. In the charging operation, when the batteries are attached to the electrodes of the charging dynamo, the solution is decomposed, metallic zinc is deposited on the steel surfaces, and red oxide of copper is produced in the porous mass surrounding the central wire of the positive plate. In the discharge a reverse operation takes place. When current is taken from the battery, the alkaline solution dissolves the metallic zinc, while the hydrogen, going to the other pole, produces the oxide of copper which has been formed there in the charging operation. It will be seen that in its discharge the battery is virtually a Lalande-Chaperon couple of the type so favorably known here in the Edison modification.

For the cell thus produced most remarkable results are claimed. On short circuits almost any current can be yielded by it without deterioration. The alternate oxidation and reduction of the positive plate is of such a nature that the plate is absolutely free from any danger of buckling. While its working current averages 40 amperes, 1,000 or more can be taken from it. On the low discharge its resistance is about 1-1000 of an ohm, which resistance, very curiously, becomes reduced on the high discharge to about one-half of this amount. Its electromotive force on discharge is 0·89 volt, and for charging only 0·94 volt is required, a much smaller excess than in the case of the lead storage battery. The capacity of the cell is 240 ampere hours. Its weight is 28 pounds.

In the charging some interesting points are to be noticed. The oxide of copper to be produced is the red or cuprous oxide; not the black oxide. When the latter begins to form, an instant change in the voltage occurs, which indicates when the charging is completed. Again, as the zinc is deposited on the steel plates, if the distance between them and the positive plates is uneven, there is danger of a building up of zinc on the negative at this point, something which has to be guarded against. To preserve the alkaline liquid a layer of heavy oil is poured upon its surface, which prevents the carbonic acid gas of the air from combining with the alkaline solution.

On each car there are 144 cells, weighing altogether 4,032 pounds. They are carried on special trays provided with rollers and are introduced beneath the seats of the cars through openings in the dashboard and end of the car body, being rolled in and out by power.

In this appears what is really one of the distinctive details of the system. By a traversing table the car can be shifted laterally a few feet. Thus, as the car reaches the place, the new batteries may be lowered and rest in front of the car a little to one side of the car openings. The old ones are withdrawn, the car is traversed, bringing its end openings in line with the fresh batteries. These are then drawn in by power, the car is traversed back and is ready to proceed. Meanwhile the exhausted batteries are raised to the next story. The great advantage of this system is obvious. No large opening is made in the car body, and the battery is introduced in two complete sections, one for each side. Our illustration shows very clearly the methods and appliances. One set of batteries is seen in mid-air suspended from the electric crane while being taken away for charging. The other set is going into the car.



THE WADDELL-ENTZ STORAGE BATTERY.

The charging of the batteries is done on the upper floor of the building. The charging room is traversed by a 30-ton Sellers electric crane, all of whose motions are effected by electric motors. This crane is worked from an elevated stand by one man, so that the batteries are rapidly raised or lowered to the upper floor and deposited in any desired place. In charging, the batteries rest on steam coils, as the charging is best effected at a higher temperature than that of the air.

The car motor, which is shown in one of the cuts connected to the driving wheels, is a Gramme ring dynamo of the same inventors. It is of 15 kilowatt capacity and its rotation is reduced by single gear to proper axle speed. There are two on each car, thus giving a total maximum rate of about 50 horse power. On the dashboard is mounted the controller, a seven point switch, also shown in detail in one of the cuts. With this the motor man governs the car. At the first mark the current is shut off entirely. On the next point the connection is made so that the motor shall be converted into a dynamo and operate in the direction of charging the batteries. This causes it to act as a brake to some extent and also effects a certain economy on down grades and in stopping. On the other points the cells are connected in different ways so as to regulate the speed, the final and maximum speed being given by weakening the field so as to lower the counter electromotive force.

It has been found best to adopt a systematic course of operation with the batteries. Each one is introduced into its car, the proper mileage is run, and it is removed and charged for a definite period. In a sense all goes by clockwork. The batteries are not charged until they will take no more, and are not discharged to complete exhaustion. They are worked a specified period and charged for a specified period. An elaborate switchboard enables all these operations to be carried out.

The power and generating plant includes two 100 horse power Worthington boilers, two automatic Ideal 75 horse power engines directly connected to two 75 horse power Waddell-Entz 8 pole Gramme ring dynamos. In one of the cuts we show the power-generation room, with these two engines and dynamos. The plant has now been in operation for a number of months on the exhausting service of the Second Avenue line of street cars in this city, a line including several very heavy grades and well adapted for testing the manageability of the cars. Conservative figures supplied by the Waddell-Entz Company give an expense of operating of between 9 and 10 cents per car mile. The present plant has a full capacity for 18 cars, each making 80 miles a day, a total daily mileage of 1,440 miles.

Of the cells on the car, some are used for lighting, so that car traction could really be executed with a somewhat smaller battery. Each set of cells runs a car for about two hours. By the use of the electric power mechanism, when introducing and withdrawing the batteries, and for raising and lowering them and depositing them in their proper places in the charging floor, the labor item of the charging station is very light.

Exercise.

All authorities that have treated on longevity place exercise, moderate and regularly taken, as one of the main factors of a long life. That there are many exceptions does not alter the fact that physical exercise is as useful in keeping one healthy as it is to prolong life. Good walkers are seldom sick, and the same may be said of persons who daily take a certain prescribed amount of exercise. Exercise is both a preventive and a remedial measure. In my own practice I have seen a case of persistent transpiration that followed the least bodily effort, and which annoyed and debilitated the person at night—this being a condition left after a severe illness—disappear as if by magic after a day or two of exercise on a bicycle. Pliny relates that a Greek physician who took up his residence in Rome was wont publicly to declare that he was willing to be considered a charlatan if at any time he should ever fall ill, or if he failed to die of any other disease but old age. Celsus, in speaking of the same physician, observes that his faith in the benefit to be derived from exercise was so great that he had in a great measure abandoned the administration of internal remedies, depending mostly on hygienic measures and exercises. As an evidence of the correctness of his views, Pliny tells us that this physician lived to be a centenarian, and then only died from an accident.—*Nat. Pop. Review.*

THE penny-in-the slot electric lamps have come into use on the London underground railways. It is two years since the first experimental lamps were put on a few trains. Since then arrangements have been made to fit the lamps to all the trains and the work is now complete. There are four lamps in each compartment. The ordinary light is usually insufficient. A penny put in the slot obtains electric light which lasts half an hour. If more light is wanted another penny must be inserted. The lamps are placed at the back of the seat so as to throw the light on the book or paper.

THE city of Caracas in Venezuela has lately been the scene of much rejoicing over the opening of a new railway between that place and Valencia, in the interior, a distance of about 111 miles. Many difficulties in the construction had to be overcome, owing to the mountainous nature of the route. Several important bridges, tunnels, and viaducts were constructed. The road opens up a very rich and important agricultural region. The road was built under the auspices of a German corporation.

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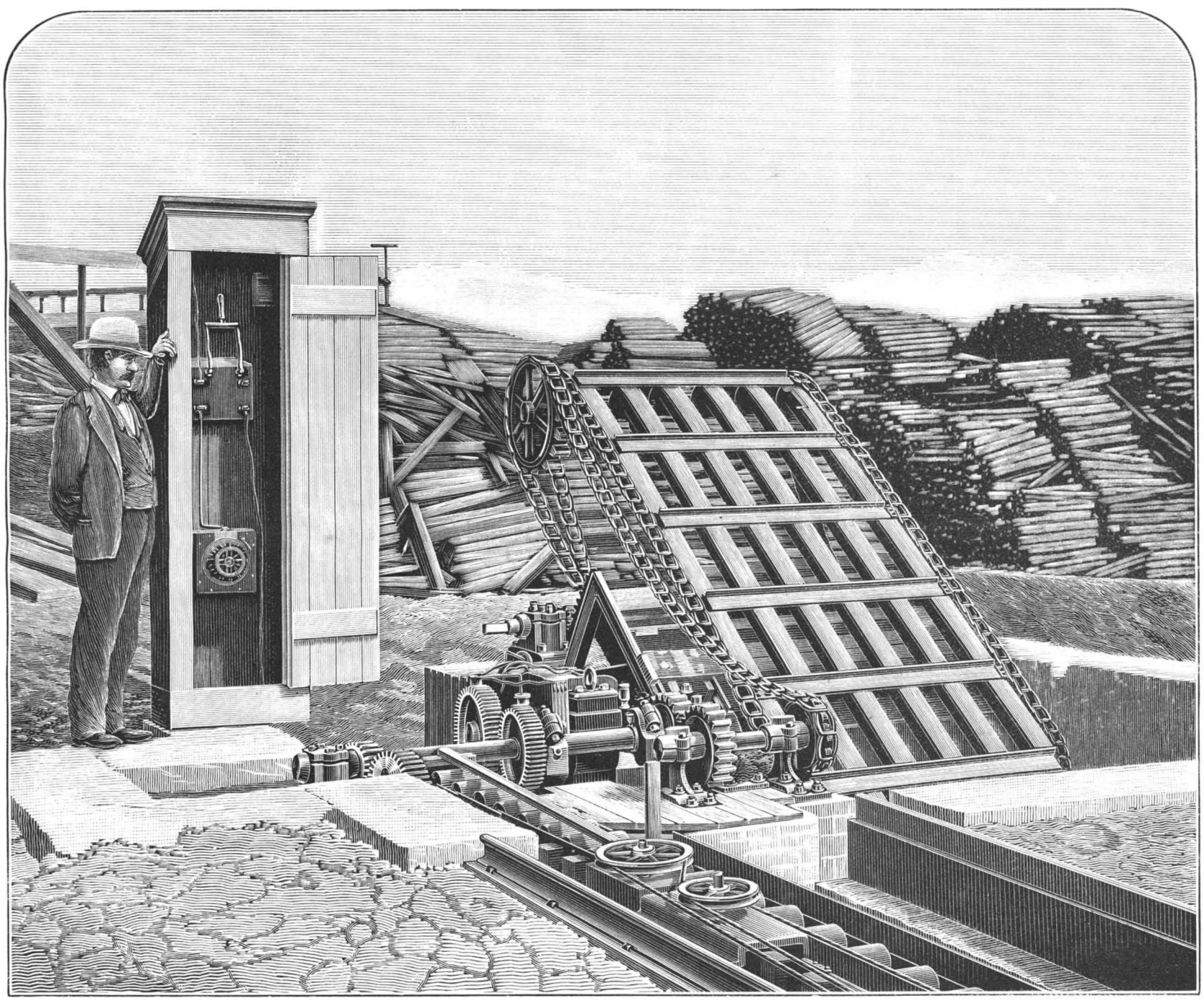
HANDLING STEEL BILLETS BY ELECTRICAL POWER.

At the works of the Illinois Steel Company, at Joliet, Ill., electrically transmitted power is now used in many operations with great economy and convenience. Our illustration represents an electrical apparatus employed to load steel billets on flat cars with the minimum amount of manual labor. After these billets come from the mill they are piled in the yard when not wanted for immediate shipment. The billets to be shipped are delivered to a long line of rollers, partly shown at the left in the illustration, and are thus carried along until they strike a deflecting plate by which they are conveyed to an endless moving apron, set at an incline, as prominently shown in the picture. This apron first elevates and then drops the billets on the car to be loaded, which is on a depressed railroad track on the farther side. This loading machine is driven by a twenty-five horse power 500 volt motor, the controlling switch and rheostat being conveniently placed in a small switch house.

Another recently introduced means of electrically using power at the same establishment is exemplified in two electro-hydraulic ingot charging machines used in the heating room. Each of these machines is practically a transfer table, 35 feet long and 15 feet wide, running on two tracks. In the center of this table, running lengthwise, is an adjustable frame, which is capable of being raised or lowered by hydraulic pressure from cylinders on either side. Running on this frame is a carriage carrying a heavy pair of jaws studded with steel teeth for gripping the ingot. These jaws can be opened, closed, raised or lowered, drawn in or out, at the pleasure of the operator, who is stationed on an elevated platform near the upright tanks, by means of levers which control the water pressure. The pressure is obtained by a triplex pump driven by a 25 horse power motor, so controlled that when the pressure reaches 500 pounds the motor is stopped automatically, but starts again when the pressure falls below this point. The traversing motion on the tracks is accomplished by a 15 horse power motor of the railway type geared directly to one of the axles of the track wheel.

In the operation of the machine an ingot is placed on the "buggy," which runs on a truck in front of the heating ovens, and stopped in front of the oven to be charged. The operator on the charging machine pulls a cord, and by means of compressed air the heavy iron door of the oven is raised. He then brings the machine to a position behind the ingot, and, by means of the levers, opens the jaws, grasps the ingot, which has been standing in a vertical position, and allows it to swing into a horizontal position. Then, by a second lever, he slides the ingot into the oven, raising or lowering it by a third lever. Should the ingot be heated on one side and it be desired to turn it over, it is gripped by the jaws, and by another lever the jaws are rotated so as to completely turn it over. The method of withdrawing an ingot is the same in reverse order. To move the table from one oven to another a lever controlling the rheostat operates the traversing motor. The heated ingot on being withdrawn from the oven is placed on the "buggy" and drawn in line with the rolls, where it is reduced in size and cut up into billets, which fall on an endless chain of rolls, which are operated by an independent motor of twenty-five horse power capacity. These rolls rise to an elevated trestle, which runs through the mill out into the yard for a distance of about 600 feet. By means of a deflecting arm these billets are distributed to any point in the yard. All of the motors are wound for 500 volts. The current for the charging machines is obtained from two overhead trolley wires, from which it is taken by two trolley wheels. Except the trolley wires, all the conductors are laid in lead-covered cables.



HANDLING STEEL BILLETS BY ELECTRICAL POWER.

A New Polar Expedition.

Mr. Frederick George Jackson, who is about to make an attempt to reach the North Pole by a route quite different from those of Nansen and Lieutenant Peary, arrived at Hull recently. Mr. Jackson, who has been spending several months within the Arctic circle for the purpose of gaining experience that will be likely to help him in his expedition, stated that he does not intend to take his ship further north than perhaps the southern extremity of Franz Josef Land. Thence he will make the journey to the pole by means of dog sledges or perhaps Russian ponies, which are very hardy. It has generally been thought that Franz Josef Land is an island, but Mr. Jackson thinks that in all probability this land extends right up to the polar seas which he, with Dr. Nansen, believes to exist. He also believes in the current to which Dr. Nansen has intrusted his ship, but hesitates to express any opinion as to whether this current will take the Fram up to the pole. After leaving his ship, the first thing he will do will be to erect a wooden house and there spend the first winter. When he sets out northward he intends, at distances of 30 to 40 miles, to set up food depots, which will be provisioned from the large cargo of preserved foods he will take out with him. These depots will be marked in such a way that on the return journey they cannot be missed, and they will not be more than one day's journey apart, so that his retreat will always, he supposes, remain open.

The Influence of the Mind upon the Body.

J. E. Wenman, M.D., in the *Eclectic Medical Journal* says:

In Mr. Warburton's work on Egypt he describes his experience with a famous magician of that country. He, being sent for, came to Mr. Warburton's hotel to give him an exhibition of his skill. The magician calls a boy from the street, and makes a mysterious mark upon the palm of his hand, requesting him to look steadfastly upon the mark. This the boy did for ten minutes without any effect. The magician called another boy, and repeated the same thing. This boy, being susceptible to the influence, was soon in a semi-mesmeric condition, the object of the mysterious mark on the palm of the boy's hand being the means of putting the boy in a passive condition. The magician now requested Mr. Warburton to call up whom he wished, and stated the boy would see him. Mr. Warburton called for the late Lord Derby: The boy instantly cried out: "Here he is! I see an old man, with spectacles, lying on a couch, having on a long black robe." Mr. Warburton next called for the late Lord Nelson. The boy said: "Here he is I see a soldier with one arm." After calling for several others, the boy minutely described them, to the astonishment of Mr. Warburton and his friends.

Now the trick consisted in getting the boy to suspend his thinking faculties, so that he would become in a semi-mesmeric condition, and thus be in sympathy with the mind of Mr. Warburton when he called for the different individuals. The boy saw in a kind of vision the very picture that was passing through Mr. Warburton's mind when he called for these individuals. This is a high development of a clairvoyant condition.

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Science Notes.

Artificial Crystallization of Carbon.—In a paper upon this subject presented to the Academy of Sciences on February 12, Mr. Moissan gives the results of his most recent investigations in this direction. By his experiments last year upon the artificial reproduction of the diamond, he established the fact that under ordinary pressure carbon crystallizes in the form of graphite, whatever be the temperature, but that, under the effect of strong pressure, crystallization gives a denser carbon. He effected the crystallization under strong pressure by suddenly cooling in water an ingot of cast iron saturated with carbon. The crystals thus obtained had the density of the diamond, easily scratched rubies and in burning gave four times their weight of carbonic acid, but the largest of them weighed no more than six milligrammes. Mr. Moissan thought that this extreme smallness of the crystals might be due to the defective conditions of cooling of the ingot, for when the latter is raised to a temperature exceeding 2,000 degrees, the liquid, through the effect of calefaction, does not touch it, and it is by radiation through the cushion of steam that the cooling is effected. He, therefore, sought another method of bringing about a sudden solidification through a lowering of the temperature. He, in the first place, tried a bath of molten tin, but without success, because at the high temperature of the experiment an alloy of tin and iron was produced. With a bath of molten lead kept at a temperature of 400 degrees, the result was entirely different. Small globules of iron rose to the surface of the lead bath by virtue of their inferior density. These globules were collected with a skimmer. Upon afterward dissolving the iron by acids, small diamonds reaching half a millimeter in diameter were obtained. Some possessed a triangular form with a striated surface, and others were of a rounded form with little cup-shaped depressions scattered over the surface. Mr. Moissan points out that this latter aspect is entirely analogous to that of certain natural diamonds. Moreover, some of the triangular diamonds became segmented in a short time—a phenomenon sometimes exhibited by diamonds after coming from the earth.

Finally, through cooling in iron filings, Mr. Moissan prepared diamonds presenting the character that jewelers call *crapauds*. These latter diamonds easily burn in oxygen at a temperature of 900 degrees. The triangular diamonds may be burned, but they leave a residuum of brilliant grains, formed probably of silicide of carbon.

Dielectrine is the name by which Mr. Hurmuzescu designates a new dielectric designed for use in apparatus of static electricity, and possessing very remarkable properties. It consists of a mixture of paraffine and sulphur, which is much preferable to either of these substances isolatedly, it being harder and less fusible than the first and less brittle and less hygrometric than the second. Thanks to a special arrangement employed by Mr. Chabaud, this product may be moulded. It is obtained in a very homogeneous and hard form, easily worked in a lathe or by a file. So various forms may be given it. Mr. Hurmuzescu has exhibited to the French Society of Physics rings, supports, bobbins and an electrophorus in which the aluminum disk carried by a dielectrine axis rests upon an insulating stand of dielectrine. With this electrophorus sparks 0·02 m. in length are obtained. It remains charged for a very long time, and operates even in a moist atmosphere. Mr. Hurmuzescu likewise presented some electroscopes in which the support of the rod to which the strips of gold leaf are attached is a disk of dielectrine. This new substance, which is very inalterable, as is proved by specimens perfectly preserved since 1892, will render great services for insulations, especially in damp places.

Purification of Steel by Centrifugal Force.—For about two years says the *Revue Industrielle*, the steel establishments of Nykroppa in Sweden have been successfully utilizing a process of purifying ingots of steel based upon the use of centrifugal force.

Around a vertical shaft is arranged a frame carrying four arms, to each of which is jointed a platform supporting four ingot moulds. The whole is so arranged that the ingot moulds remain in a vertical position when the apparatus is at rest, but incline until they occupy horizontal positions when the shaft is set more rapidly and rapidly in motion. The centrifugal force exerts a pressure thirty times stronger than that due to the column of metal in fusion contained in the ingot mould. Under the action of such pressure, the gases escape and perfectly sound ingots are obtained.

Electricity in Plants and Fruits.—There is no doubt, says *Le Genie Civil*, that nature makes use of an as yet ill known but important property of electricity in its different forms for making plants grow, flowers bloom and fruits ripen. It is a secret that it will disclose to us one of these days. Some quite curious experiments in electric culture have already been made in different places, and results have been obtained that appear to be satisfactory, but they have not yet the definiteness and permanence that would permit of profitably converting our fields and kitchen gardens into electric batteries.

It has been ascertained, however, that fruits are in a continual electric state. Upon puncturing them at the top and bottom and closing the circuit, it has been possible, by means of a multiplier, to study the variations of such electric state. The ascending sap of trees and the cortical sap, which have not, as well known, the same chemical composition, react upon each other and afford marked electric phenomena. From the pith to the cambium the layers are less and less positive, and from the cambium to the epidermis they are more and more so.

What will be the result of future studies upon this subject undertaken with commendable patience? We can only make a surmise. In the intensive hothouses called forcing houses fruits are already obtained at all seasons, and the electric light is used for giving the forced plants the impression of the dawn and of the high and setting sun. They are very sensitive thereto.

Perhaps upon combining this external action with the passage of an appropriate current into a soil charged with chemical products that it would decompose, we might succeed in producing astonishing fruits and flowers in hothouses, and, with the wand, make forests grow in bare gardens. There is nothing improbable in such magic, seeing that electricity, according to experiments already made, plays a role as mysterious as preponderant in vegetation.

Action of Light upon Water Colors.—Water color artists and the collectors of their work will be interested in and benefited by the results of a study recently made in England by Mr. Richardson relative to the action of light upon water colors. Mr. Richardson spread the colors upon Whatman paper and afterward placed them in a dry, damp or gaseous atmosphere, some in darkness and others in light. This research permitted him to classify the colors in two groups, the first comprising those that fade in consequence of the oxidation due to humidity, air and light and the second comprising those upon which light alone exerts a reducing influence. In the first group are placed the sulphides, cadmium, which, despite its old reputation, fades in a fortnight in damp air, trisulphide of arsenic, very sensitive to damp air, and indigo, which is not sensitive to dry air or an atmosphere of carbonic acid.

In the second group must be mentioned Prussian blue, which fades in the light and in carbonic acid, and resumes its former color in the air and in darkness. The lakes are decolorized, as are also vermilion and Naples yellow, under the combined action of light and dry or damp air. On the contrary, cobalt red, Indian red, yellow ocher and sienna undergo no modification. Upon the whole, light acting in a damp atmosphere is the principal enemy of water colors.

Kruppine.—In the *Elektrotechnische Zeitschrift*, Mr. Dettmar gives the results of an investigation of a new alloy (the composition of which is not stated) especially designed for industrial resistances.

This metal, manufactured by Krupp at Essen, and named kruppinè in his honor, is characterized not only by a great resistance, but also by mechanical properties that permit of its being very easily worked. Its resistance, when it is well annealed, is 83 microhms-centimeters, that is to say, fifty times greater than that of copper. Its coefficient of temperature is equal to 0·0013, and is therefore less than that of copper.

Mr. Dettmar, after measuring these two constants, endeavored to ascertain how many spirals should be wound upon a helix of one meter in order to absorb a maximum number of watts without producing a dangerous heating. It is not, as one might be led to believe, the greatest possible number of spirals that gives the best result. With helices of a diameter of 13 and 18 millimeters and wires of 1 millimeter and 2·3 millimeters, Mr. Dettmar finds that the best winding is that which leaves between two consecutive spirals a space equal to twice the diameter of the wire. He finds, besides, that two helices of different diameters (13 and 18 millimeters) support almost the same current when both are so wound as to give the maximum effect.

Flexible Glass.—According to the *Practische Maschinen-Constructeur*, a material called "flexible glass" is made by dissolving from 4 to 8 parts of gun cotton in 1 part of ether or alcohol and adding to the solution from 2 to 4 parts of a non-resinous oil and from 4 to 10 parts of Canada balsam. This mixture is spread upon a plate of glass and dried in a current of air of a temperature of 50°. There is thus obtained a hard and transparent mass, the thickness of which may be regulated at will, and that offers a perfect resistance to salts, alkalies, and acids. These plates are odorless, very flexible and tough. Their inflammability may be diminished through the incorporation of chloride of magnesium. The addition of zinc white gives them a beautiful ivory color.

Soap Paper.—There has recently been brought out in France a sort of fancy soap for the use of those who are obliged to do considerable traveling. It is a question of small pieces of paper, slightly larger than visiting cards, covered on each side with a thin layer of ordinary soap or of soap variously colored and perfumed. These soap papers are put into memorandum books, card cases, or pocketbooks, just as if they were business or visiting cards. Each sheet serves as soap for one time only, and is used like an ordinary cake of soap. In fact, it is an easily carried soap that may be offered to a traveling companion, for every sheet is intact, it having to be used but once.

The manufacture of this soap paper is very simple. It consists in immersing sheets of unsized paper in a bath of cocoanut oil soap prepared in the same way as for the manufacture of toilet soaps. The strips of paper are dried, and then passed between rollers, in order to render them smooth and give them a handsome appearance. The strips are then cut to the proper dimensions and stamped with such marks as may be desired.

Instead of paper there may be used squares of parchment paper, or better still, of tracing cloth. This industry is still new, and we do not yet know what development is in store for it.—*La Nature.*

A Precaution Against Consumption.

It is now pretty well established that tuberculosis is an infective disease, and if this is true, it is largely preventable. We believe that in this country especially there is not sufficient stress laid upon the communicability of consumption; the people are too apt to regard our climate (Southern California) as Nature's panacea. Phthisical patients fairly swarm upon us every winter, poisoning our hotels, our streets and our dwellings. The inspissated sputum retains, according to Sawizky, its virulency two and a half months. Here, since the advent of the one-lunged Yankee, children die of meningitis and youth of consumption. This we are told by some to regard as the unfathomable dispensation of a wise Providence, when it rather should be charged to the criminal negligence of an easy-going public.

Persistent and systematic precautions ought to be taken by both public officials and the people in general to stop this scourge. The health department should issue stringent orders, classifying this disease among those usually placarded.

The room occupied by a consumptive should receive as thorough a disinfection as the one used by a diphtheritic patient. If the phthisical patient died in a week or two, the quarantine should be demanded and carried out. If the public really thought consumption "catching," they would regard it just as natural to take precautions against its spread as it is to stamp out leprosy. In point of fact, there is no comparison between the contagiousness of these diseases—tuberculosis being much more communicable. A campaign of education is needed.

All tuberculous patients should be compelled for the public good to use spit cups. Public spittoons filled with sawdust or other matter easily combustible should be placed at convenient intervals. The American has been described as a spitting animal, but he must be trained to spit by law only in specially prepared receptacles. The old college saying, "Those who expectorate on the floor cannot expect to rate as gentlemen," should be impressed upon all.

Then, again, the dust of the streets ought to be removed frequently, but only after a thorough sprinkling. Public hospitals for the tuberculous poor ought to be established. In the present state of affairs only a very few of the very worst cases are treated—while thousands wander about the city polluting the very air with the germs of the greatest scourge that has ever afflicted mankind.

Hygienic treatment should be advised in all cases. Preventive medicine is no longer the medicine of the future, but the medicine of to-day. Let us follow the example of Michigan, and officially declare consumption a contagious disease. Another point of great importance is the denying to consumptives the privilege of engaging in occupations whereby they may endanger the life or health of others.

The sanitary inspection of cattle and the condemnation of tuberculous cows should be rigidly enforced. Indeed, did our government take half the interest in preventing disease among human beings that it does in looking after the health of hogs and cattle, there would be thousands of lives saved annually.—*Southern California Practitioner.*

Russian Harbor on the Arctic Ocean.

The plan of constructing a large Russian naval port on the borders of the Arctic Ocean, close to the Norwegian frontier, where the sea is free from ice during the winter on account of the Gulf Stream, is not by any means abandoned. The plan also comprises the building of a new railway from Uleaborg, the northerly terminus of the Finnish railways, to the port in question. This railway will be about 470 miles long, and its terminus will be either at the Peschang Bay, close to the Norwegian frontier, or at Port Wladimir. There are no serious ngineering difficulties in the way of such a railway, and as it will be built on a cheap system, much used in Finland, the cost would only amount to some £2,700,000—$13,000,000.

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A Sewer on Piles.

Owing to the soft mud great difficulty was found in building the new sewer which is to occupy the Aramingo Canal from the river to Huntingdon Street, Philadelphia. After considering other devices, says *Architecture and Building*, the plan was hit upon of using an extensive system of piling.

Great yellow pine timbers, 12 inches square, are to be driven to solid bottom, 3 feet apart. Transversely in these will rest yellow pine planks, 8 by 8 inches. Broken stone will be filled in two feet deep around the heads of the piles to brace them. On the transverse timbers is a plank flooring, 6 inches thick, and above this the sewer is built, secured at the bottom by a bed of heavy stones laid in concrete. The main sewer will be 9 feet 6 inches in diameter. Below York Street there will be twin sewers, each 8 feet in diameter.

The construction of the canal sewer necessitates the entire reconstruction of the 10 foot sewer on Huntingdon Street as far westward as Sepviva Street, in order to secure the proper slope for drainage. The work will cost nearly $1,500,000, and will be completed under favorable conditions in about a year.

BICYCLE BOAT.

Small pleasure boats propelled by a screw actuated by pedals have been observed since last summer upon one of the lakes of the Bois de Boulogne. Their mechanism is ingenious. The idea of substituting a screw actuated by pedals for oars or paddle wheels is not new, but this is the first time that we have seen it realized in a sufficiently practical manner to assume the proportions of a genuine enterprise. The motive system of this new boat, devised by Mr. Vallet, has much analogy with that of bicycles, and it is for this reason that it has been called a bicycle boat. One of the models especially (the one represented at the bottom of the engraving and figured 2), which is designed for one person, recalls the bicycle. In another model, designed for several persons, the saddle is replaced by an arm chair, as shown in the general view at the top of the engraving. In both systems, the motor is the same. It consists of a horizontal shaft that passes through the stern of the boat and carries the screw. To this shaft are keyed two bevel wheels, A and B, either of which may be thrown into gear at will with a third mounted upon a vertical axis. This latter receives motion from the pedals through the intermedium of an endless chain running over a sprocket wheel. A hand wheel keyed to the top of this axis keeps up the motion and renders it regular.

The shaft of the screw is movable in the direction of the length of the boat, and this, through a system of levers, D C, that the pilot has within reach, permits of throwing either the pinon, A or B, into gear at will. There is thus obtained, without any necessity of modifying the motion of the pedals, a backward or forward movement or even a complete stoppage, if the shaft be given an intermediate position. As for the steering, that is effected through a bar, analogous to that of bicycles, which controls the rudder.

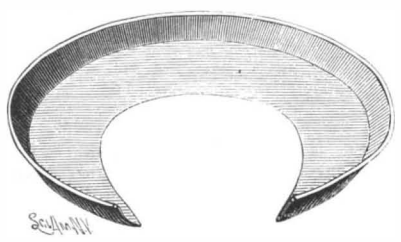
The ratio of the gearings is so calculated as to obtain a multiplication of five, and the pitch of the screw is 58 centimeters. Each revolution of the pedal therefore causes the boat to move forward 2·9 meters. Supposing that one stroke of the pedal be given per second, an advance of 174 meters will be made per minute or 10·5 kilometers per hour. But practically it would be impossible to keep up one stroke of the pedal per second very long, and it is necessary, too, to take into account the resistance of the water, which increases very rapidly with the speed of the boat. From our own experiments, we believe that it is possible to attain a speed of about eight kilometers per hour in calm water and without wind.

This question of speed, however, is of no great importance, for we have a pleasure boat rather than one for racing, and the speed is of slight consequence, provided that it be adequate. We have been surprised at the easy motion of the pedals and at the facility with which the maneuvering is done without fatigue. It is a very agreeable mode of locomotion, that we find more convenient and more within reach of every one than that effected by the oar or paddle.—*La Nature.*

TRICK PHOTOGRAPHY.

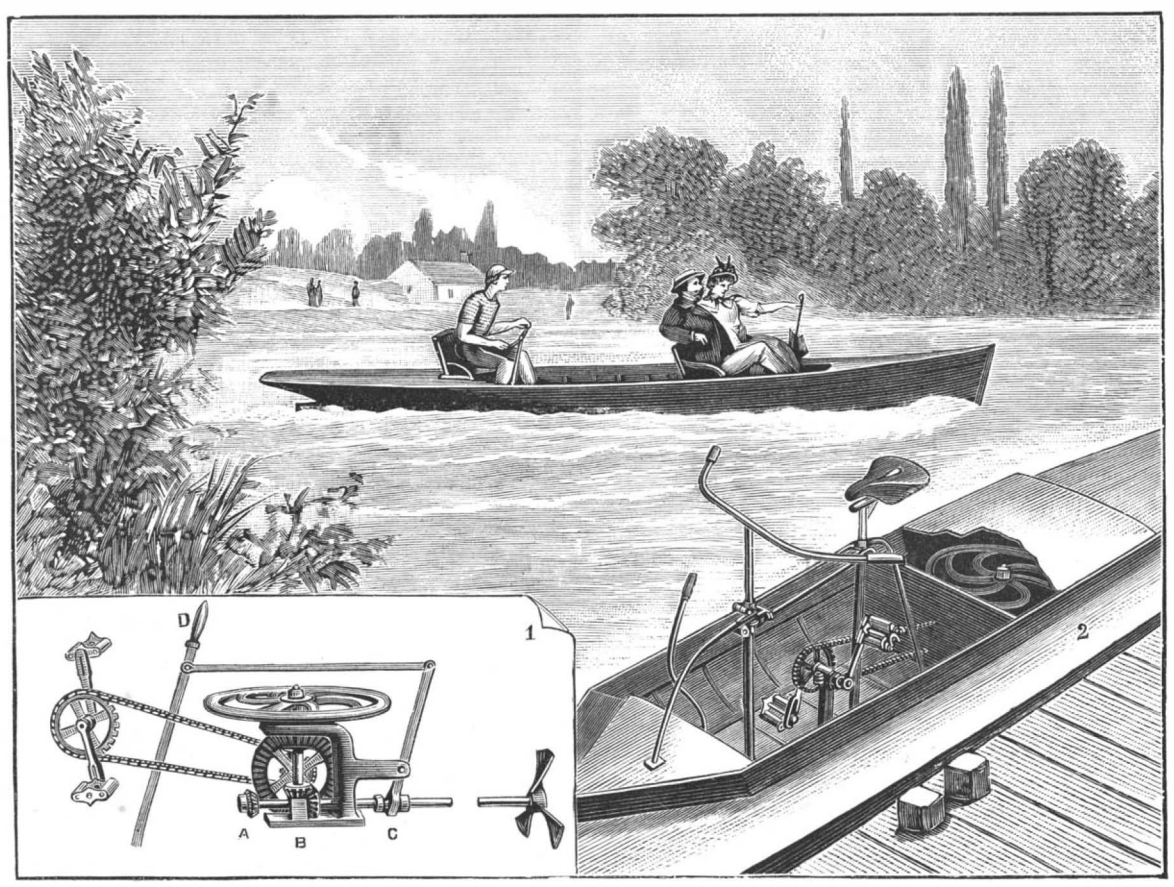
In the SCIENTIFIC AMERICAN of March 3 we described how, by a simple attachment to an ordinary kodak, one could easily take pictures of the same person in different attitudes on one plate. The illustrations given were the work of Mr. Frank A. Gilmore, of Auburn, R. I., who has also sent us the photograph from which is made the accompanying representation of what appears to be the head of a living person on a platter, forming part of the furnishing of a dining room table. Although the way in which the work is done is very simple, pictures made in this manner have been extremely puzzling, and are of especial interest to amateur photographers, as they suggest other methods of producing novel effects. In this case a center leaf was removed from an ordinary extension table, the lady to be photographed then being seated so that her head appeared just above the table top, on which the cloth and other articles were arranged as nearly as possible in the usual way, as shown in one of the views, the table being built up in place of the removed leaf sufficiently to support the cloth and other articles. To make the illusion complete, a pan, cut away so that it may be conveniently placed around the neck, as shown in the small picture, has the appearance in the photograph of being an ordinary platter, bearing the head of a living person.

HEAD OF LADY PHOTOGRAPHED ON A PLATTER.



PAN CUT AWAY TO REPRESENT PLATTER.

HOW THE PHOTOGRAPH IS MADE.



BICYCLE BOAT OF THE BOIS DE BOULOGNE.

Influence of Horticulture on the Manners and Customs of the People.

This was the subject of a most interesting and instructive paper lately read by Mr. Harper, custodian of the Aberdeen Duthie Park, to the members of a working men's guild in Aberdeen. After a historical introduction, in which he referred to the Garden of Eden, Mr. Harper said the floralia of the ancients survive to-day in the "battle of flowers" to be seen in Algeria and Italy. Cleopatra paid £200 for the roses employed at one banquet. The first school of gardening was the Jardin des Plantes at Paris, yet the science of horticulture was less generally known in France than in this country. Modern British gardening received its first stimulus in the reign of Henry VIII. It changed under Charles II., again under George II., and in the reign of George III. was profoundly affected by the introduction of flowering plants from North America. The establishment, in 1824, of the experimental gardens at Inverleith Row, Edinburgh, did a great deal for gardening in Scotland. In our own time horticulture is slowly but surely influencing our people to a more correct taste and appreciation of beauty. The parks are being more appreciated every year; a neat flower bed commands the attention and respect even of the vulgar. Horticultural exhibitions are of the greatest use to those engaged in horticulture. Mr. Harper spoke strongly of the work of the guild in the culture of plants in houses. In the child's love of flowers we have the voice of nature; it falls into decay as vice and selfishness harden the tender heart. Speaking of open spaces in the heart of the city, Mr. Harper said they could not fail, if well kept, to be a great benefit to the whole community. A modern feature is the tasteful arrangement of autumn foliage, a form of decoration at once effective and inexpensive.

Aluminum Yachts.

Two examples of aluminum built yachts are at present to be seen in French waters. One is the ten ton yacht Vendenessa, launched recently from the stocks of the Societe de Chantiers de la Loire. The other is a 33 foot sailing boat. The former craft has been built for the well known French yachtsman, Comte de Chabannes, La Palice, from the designs of M. V. Greilloux. It is computed that if this vessel had been constructed of steel frame and wood planking, like other boats of her class, her hull would have weighed some 4 tons 5 cwt., but in aluminum the weight is only some 2 tons 6 cwt. The other craft referred to is named the Jules Davoust, and with it Lieutenant Hourst intends to set out on a survey expedition on the Niger. This craft affords additional proof of the great suitability of aluminum as the structural material for boats intended for exceptional purposes, such as river survey and exploration. The boat complete only weighs 18 cwt., a fact which sufficiently indicates the extreme portability of the craft when overland transport is involved.

THE Gates Iron Works, Chicago, manufacturers of the gyratory rock and ore breaker, known as the Gates Crusher, have recently purchased the entire plant—tools, machinery, stock, patterns, drawings, etc.—of the Chicago Iron Works. With this valuable addition to their plant, the Gates Iron Works are in a better position than ever before to build any kind of machinery required for the reduction and treatment of ores of whatever nature. The Gates Company have had half a century of experience in this line of manufactures, and furnish modern machinery of the highest merit, both as regards material and workmanship.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Royal Z. Pooler, St. Joseph, Mo. In this engine the piston on the main driving shaft is made in the shape of a wheel, and provided with wings forming steam compartments on opposite sides of an annular transverse partition, no valves, gates, or abutments being used. The live steam acts on the wings as it passes into the compartments, and a rear wing cuts off the steam by passing over the ports, the compartment then connecting with the exhaust, and on the next quarter revolution again taking live steam, each compartment receiving live steam twice on each revolution of the piston.

WAVE MOTOR.—James C. Walker, Waco, Texas. The mechanism of this improvement comprises an air-holding tank, an air buoy or chamber having an open bottom at a point below the trough line of the wave and an upper portion extending above the crest line, a pipe connection within the buoy opening extended into the upper portion and to the air-holding tank, and provided with back pressure valves. By this means air is compressed for use in an engine on the land, the amount of power obtained being proportionate to the force of the rise and fall of the waves.

Mechanical.

MORTISING MACHINE.—Daniel Hepp, Chicago, Ill. This is a simple and inexpensive machine for use in connection with an ordinary boring machine having a sliding arbor, to quickly and nicely mortise the stiles of window frames to produce the holes for the pulleys, the mortise for the pulley hanger flanges, etc. A central bit is mounted in a bearing box and provided with a gear wheel, and in the box are shafts with gear wheels meshing with the gear wheel of the central bit and carrying bits, while hollow chisels secured to the box inclose the side bits. The ends of the mortise may be made round or square as desired.

SPINNING SPINDLE SUPPORT.—Robert Atherton, Paterson, N. J. A bolster casing is, according to this invention, supported by its upper end on the spindle rail, the bolster fitted in the casing and projecting through its lower end, there being a cottar on the lower end of the casing, a spring between the collar and spindle rail, and a locking ring removably secured on the lower projecting end of the bolster. The device permits the spindle to yield somewhat laterally and compensate for variable strains, and facilitates the removal of the spindle and its bolster from the spindle rail of the machine.

Agricultural.

WEED CUTTER.—John F. Dole, Colfax, Washington. In this machine the cutter is shaped practically as a wheel, held at the rear of the supporting wheels, and caused to revolve rapidly by a sprocket chain from the axle, the wheel carrying a series of curved blades so arranged that they enter the ground first at one end and gradually bury themselves their entire length. The machine is strong, simple, and inexpensive, and cuts the weeds at the roots, below the surface of the ground.

CORN PLANTER ATTACHMENT.—Andrew W. Trotter, near Petersville, Ind. This is an improvement on a former patent of the same inventor, providing a furrow-covering attachment adapted to supersede a covering share. The attachment consists of a twisted standard adjustably attached to the beam and carrying at its lower end a disk wheel traveling at an angle to the path followed by the plow, causing the earth to be fed in a steady stream over one side of the furrow and over the seed. The attachment is as easily applied or removed as the ordinary covering shares.

Miscellaneous.

ORE CONCENTRATOR.—Carl G. Pingel, Butte, Montana. This concentrator comprises a bowl having wheels on its under side, and an annular gutter and spout leading therefrom, with means for imparting a rotary and a jigging motion to the bowl, an inclined sluice having a corrugated bottom into which the spout discharges, with means for imparting a jigging motion to the sluice. An annular flange retains the quicksilver in the bottom of the bowl, and the precious metal retained and amalgamated is drawn off at intervals through a capped outlet. The apparatus is of comparatively simple construction.

FLOOR WASHING MACHINE.—Joseph C. Garrott, Brooklyn, N. Y. This machine has a main frame with suitable driving wheels driving an endless belt provided with a series of flaps, a water tank delivering upon the belt, which is also engaged by wringing rollers, beneath which is supported a dirty water tank. The flaps absorb the water and bring a large rubbing surface to bear on the floor as they are carried beneath the roller, the belt and its flaps then passing between the wringing rollers and the machine being used by simply pushing it across the floor, after the clean water pipe has been opened.

STEAM COOKER.—John A. Kendall, Maysville, Mo. In a pan holding the water is a frame supporting vessels containing the food, a cylindrical cover fitting over the frame and entering into the water, while a supporting device holds the cover at different heights. This cooker will hold several vessels of different sizes in such a way that they may be readily inserted or removed, the cooking being effected by steam at a little higher pressure than that of boiling water.

TABLE.—John Heissenberger, Athol, Mass. A card or game table is provided by this invention, one arranged to enable the players to conveniently place money, match boxes, glasses, etc., and leave the whole table unobstructed. A money drawer slides horizontally under the table top, and is connected with a treadle to be actuated by the player's foot, and there are side compartments, each provided with a slide adapted to support glasses, etc., and similarly connected with a treadle mechanism.

COMBINATION FURNITURE.—Costello B. Geer, Union City, Pa. This is a cheap and simple construction which may be made to serve the purposes of a blackboard, a desk, a secretary, and a copy-holder, simultaneously or one at a time. A main board has a blackboard surface and a ledge at its lower edge, a swinging desk board being adapted to lie vertically in front of the blackboard or project from the ledge at an inclination or hang down, while a copy-holding case secured to the blackboard has an open face and suitable lid, a spring-pressed plunger moving forward the copy, there being also secretaries hinged to the side of the main board.

COMBINED BOARD AND CUTTER.—Alonzo H. Seaver, Webster City, Iowa. This is an improvement in paper hangers' appliances, a swinging leaf carrying the cutter, and being adapted to lie on the paper to hold it in place and produce a straight edge, the leaf being adjustable in and out upon the table, or it may be dropped down out of the way. The cutter is adapted to readily and smoothly cut pasted paper, having cutting disks which operate by simply pushing the cutter upon the table.

ALARM BELL.—Charles S. Bradley, Portland, Oregon. This is a device of such construction that, when attached to a door, the driving mechanism is wound up by the closing of the door, but when the door is opened a striking mechanism is set in operation, the alarm not needing to be wound by hand at any time and being always ready for use. A train of gearing connects a master wheel and a hammer which strikes the bell, while a plunger operates a spring-pressed winding arm when moved in one direction and releases the arm when moved in the opposite direction.

BOOK.—Alfred C. Nisson, Chicago, Ill. This is an improvement in books having detachable covers, providing therefor a cover or binder which permits economy of paper, as the paper may be written upon close up to the back of the book. The device is very durable, being designed to outlast many fillers, and it is so made that the filler may be easily and quickly inserted and removed.

HAME HOOK.—William J. Dankworth, Temple, Texas. This is a latch hook comprising two plates, one curved at one end and slotted to receive the tongue of the other, so as to form an eye for the hame staple, one of the plates also having lugs engaging recesses in the other plate, and each of the plates having slots curved in opposite directions and having their inner ends in register with each other. The device is simple, and will securely lock the trace link in place to prevent accidental displacement.

FLUSHING APPARATUS.—William A. Eberhart, Asbury Park, N. J. This is an improvement in devices for emptying a tank at each discharge, as in flushing the bowls of water closets, the apparatus operating noiselessly, emptying the tank quickly, and not readily getting out of order. It is also adapted to deliver a small supplemental charge into the bowl after the water has ceased to flow through the main discharge pipe.

BOTTLE.—Ross B. Yerby, Brooklyn, N. Y. This bottle has a neek so made that the bottle may be easily emptied, but cannot be refilled, thus preventing a certain kind of cheating, as when valuable liquors are removed from a bottle surreptitiously, and the same quantity of an inferior grade added. Immovably fastened in the neck of the bottle is a bushing in which a valve is held to move between seats, there being side openings in the bushing and zigzag ports leading therefrom, while passages lead from the ports to the interior of the bushing.

HAIR CURLER.—Eugene Deucher, Cleveland, Ohio. This device consists of a spring fork having a reduced neck and a spring finger, extending alongside the fork, the finger being formed at one end into a spring coil that encircles the fork neck and is adapted to revolve thereon. It is a very cheap and simple device, easily applied to the hair and easily removed; it may be left in the hair any desired length of time without inconvenience, and is designed to make a very handsome curl.

CURLING IRON HEATER.—Samuel O. Fowler and Walter R. Taylor, Fort Worth, Texas. This is an attachment for gas burners or lamps to facilitate the heating of curling irons or other light articles. It consists of a cylindrical shell with a flat top and slots near its top, a lateral handle near the base, and a sight aperture with transparent cover; it also has a removable flanged bottom piece with perforations in its base, and an upright holder tube centrally in the bottom piece.

FINGER REST FOR PENHOLDERS.—Max Goetze, Sturgis, South Dakota. A flat spring adapted to lie against the inside of the finger is secured to an open finger loop, and yielding eyes in which the penholder is inserted are secured to the under side of the spring, by which the pen may be yieldingly held on the first finger in position for writing, insuring also a correct position of the pen in teaching children at school.

THERMOSTAT.—Earl Barney, Schenectady, N. Y. Upon an electrical conducting base is a post in which is mounted a laterally extending blade made of materials of differing expansibility, there being at opposite sides of the blade near its outer end insulated posts in which are held adjustable contact screws. The device is well adapted to use in small places where it is hard to reach and adjust the thermostat, is very sensitive to changes of temperature, and is especially adapted for use in incubators and similar apparatus.

SELF CLOSING HATCHWAY.—William R. Wemple, New York City. This is a simple and durably constructed apparatus, designed to automatically and positively close the hatchways in case of a fire in a building. A hand mechanism is also provided to close the doors during the night or at any other time when the elevator is not in use. The several working parts are located outside of the elevator shaft in the different stories of the building, and are easily accessible for inspection and repairs.

WAGON JACK.—Luke L. Kellogg, Leon, N. Y. One of the pivoted strut members of this jack has an enlarged portion to form a seat, and the lifting lever or arm pivoted between the strut members has a seat adapted to engage the axle, and when the lever is swung down to shift the axle onto the seat portion of the strut members. The jack adjusts itself to any height of wagon without changing any of its parts, and will keep the wagon from going back or ahead.

PUZZLE.—Henry Walton, Vicksburg, Miss. A flanged board forms a square inclosure in which are located seven blocks, the inclosure being capable of receiving eight blocks, each block being double its width, and two pairs of blocks having designations thereon. The puzzle consists in changing the positions of the marked blocks by certain moves without turning them around or taking them from the field.

Designs.

SIDING BOARD.—George R. Boyd, Cairo, Ill. This board is beveled, and at its thicker edge has a rabbet-like recess on its under side, opposite which the top of the edge is cut away in ogee form.

CAPE.—Julius Adler, Jersey City, N. J. The body and the collar of this garment have each a plait-like configuration, such configurations being united by zigzag lines arranged opposite each other on the outside and inside of the cape.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE LAW OF PSYCHIC PHENOMENA: A WORKING HYPOTHESIS FOR THE SYSTEMATIC STUDY OF HYPNOTISM, SPIRITISM, MENTAL THERAPEUTICS, ETC. By Thomson Jay Hudson. Chicago: A. C. McClurg & Company. 1893. Pp. xvii, 409. Price $1.50. No index.

The object of this volume, the author states, is to assist in bringing psychology within the domains of the exact sciences. Whether it will succeed in doing it or whether it ever will be done, is doubtless a very open question. All the well known topics, such as hypnotism and crime, hypnotism and medicine, and mental therapeutics, are included. With the author's conclusions we cannot well agree. The want of an index is made up to some extent by a very full contents.

THE POLITICAL ECONOMY OF NATURAL LAW. By Henry Wood. Boston: Lee & Shepard. 1894. Pp. 305. Price $1.25.

This work is a very practically arranged treatise on political economy, its general purpose, as stated by the author, being to outline a system which is natural and practical. Political economy is something about which two people never seem to agree, but none can question the fact that Mr. Wood in this volume has most excellently distributed and classified his matter and produced an exceedingly attractive book on what has been termed the "Dismal Science." It is divided into sections, 24 in number, and the presence of a full and adequate index is among its most commendable features.

CAMBRIDGE NATURAL SCIENCE MANUALS. Physical series. Heat: an elementary text book, theoretical and practical, for colleges and schools. By R. T. Glazebrook. Cambridge. 1894. Pp. x, 230. Price $1.

The modern system of teaching physics is here elucidated, and a series of excellent experiments on heat, adapted for performance by students in laboratories, with full deductions of the principles and laws of heat therefrom, make a most attractive work. It is excellently illustrated, and must be considered a very interesting and valuable contribution to modern text books. One relief it suggests is that it is not written for a sharply defined examination course, although designed specially for medical students in the Cavendish laboratory.

SEWAGE DISPOSAL IN THE UNITED STATES. By George W. Rafter and M. N. Baker. New York: D. Van Nostrand Company. London: Sampson Low. Marston & Co., Lim. 1894. Pp. xxvii, 598. Price $5.

How to dispose of sewage is becoming a question of increasing importance in this country. Here and abroad the most varied process s have been used for the work, with naturally the most varied results. In this exhaustive treatise we find the subject very fully treated from the American standpoint. It is in vain for us to attempt to give any idea of the work from a review. The best we can do is to state that to the sewage engineer it will be a *sine qua non*, a book he cannot dispense with. After the general treatment of the subject the author gives in succession examples of different sewerages in various named places in the United States. An excellent index is a commendable feature, and illustrations and tables are supplied with the regular text. as required.

THE ELEMENTS OF CO-ORDINATE GEOMETRY. Part I. The equations and properties of the right line and circle. By William Briggs and G. H. Bryan. London: W. B. Clive. Pp. xi, 220. Price $1.40.

This very attractively printed little work of the University Correspondence College Tutorial Series is written for the London examinations or, at least, to assist students in preparing for these examinations. The idea apparently is to help beginners out of their difficulties. The very clear cuts and general make-up of the work indicate a probable success in doing this, yet, to users in this country, it loses a certain amount of interest from the fact that it is written from the limited standpoint of the London University.

PRACTICAL BUSINESS BOOKKEEPING BY DOUBLE ENTRY. 1893. Boston, New York, Chicago. London: D. C. Heath & Co. Pp. viii, 238. Price $1.75.

This work derives standing interest from the fact that it is written by the instructor in bookkeeping in the English High School in Boston. It presents an excellent and adequate statement of bookkeeping by double entry, and it will be found of use, doubtless, by many of our commercial schools. A rather useful feature of it is its appendix containing abbreviations, characters and definitions, used in commerce.

ELECTRIC WAVES: BEING RESEARCHES ON THE PROPAGATION OF ELECTRIC ACTION WITH FINITE VELOCITY. By Dr. Heinrich Hertz. London and New York: Macmillan & Co. 1893. Pp. xv, 278. Price $2.50.

This book may justly be termed one of the monuments of physics of the end of the 19th century. It is a translation of a work by Dr. Hertz on his famous ether wave experiments. It is needless for us to tell our readers what these experiments are. They indicate the identity of electro-magnetic oscillations and of light waves, they go to confirm the Clerk-Maxwell theory of light, known as the electro-magnetic theory, and, at last, they make accessible to readers Dr. Hertz's own account of his remarkable researches. The statement must be noted also that the work possesses additional value from a short preface by Lord Kelvin, better known as Sir William Thomson, which preface, short as it is, is by no means the least valuable portion of the work.

"The Book of the Fair," edited by Hubert Howe Bancroft, and published by the Bancroft Company, Chicago, is a superb work, in every way worthy of the great World's Columbian Exposition which it commemorates and the most notable features of which it presents in strikingly realistic illustrations for permanent preservation. It is published in large quarto form in serial parts, ten numbers of which have already appeared, the parts being one dollar each. Owing to the perfection attained within a very recent period in making relief plates direct from photographs—plates which may be printed from directly in the type forms—it is possible now to make pictorial representations far surpassing in multiplicity of detail and vividness of effect anything which could have been done at former world's fairs, and in this work full advantage is taken of this fact to bring before the reader, in the pictures, a wealth of life-like views of the buildings, the exhibits and the exhibitors. There will be over 2,000 of these superb pictures, and the accompanying letter-press description is filled with a careful arrangement of the most important and interesting information relating to them. It may worthily claim, in the words of its publishers, to be a book "to entertain and instruct the people of all ages and places."

SCIENTIFIC AMERICAN BUILDING EDITION.

MARCH, 1894. (No. 101.)

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1. Elegant plate in colors showing a handsome suburban dwelling at Nutley, N. J., erected at a cost of $4,500 complete. Floor plans and perspective elevation. A tasteful design. Mr. E. R. Tilton, architect, New York.
2. Plate in colors showing an attrative residence at Providence, R. I. Perspective view and floor plans. Estimated cost $5,500 complete. An excellent design.
3. A dwelling recently erected at New Haven, Conn. Perspective view and floor plans. A unique design.
4. A beautiful residence at Edgewater, Chicago, Ill., recently erected for Clarence M. Stiles Esq. Perspective and floor plans.
5. Engravings and floor plans of a suburban residence erected at Belle Haven, Conn. An attractive design. Messrs. Boring & Tilton, architects, New York.
6. A suburban dwelling recently erected at Elizabeth, N. J., at a cost of $4,200. Floor plans and perspective elevation. Messrs. Charlock & Howard, architects.
7. A Queen Anne cottage at Ardmore, Pa., recently completed for Mr. Frank A. Apple. Floor plans and perspective elevation. An artistic design. Mr. J. M. Harlan, architect, Ardmore, Pa.
8. Two cottages at West Haven, Conn., erected at a cost of $2,050 and $2,200 each. Floor plans and perspective elevations. Mr. Rollin L. Hine, West Haven, Conn., architect. Instructive designs.
9. A Swiss cottage at Glenbrook, Conn. Perspective view and floor plans. Mr. D. W. King, New York, architect. An attractive design.
10. A Queen Anne cottage at Wyncote, Pa., erected at a cost of $4,300. Mr. Angus S. Wade, architect, Philadelphia, Pa. An excellent design.
11. An attractive residence at Hartford, Conn. Floor plans and perspective elevation.
12. Sketches of John Milton's cottage at Chalfont St. Giles, and interior view.
13. Page engraving, showing the west (main) facade of the new German Reichstag building, Berlin. Plans drawn by Paul Wallot.
14. Miscellaneous Contents: The decoration of the Pantheon.—A cheap and efficient water motor, illustrated.—Stamped steel ceilings and side walls, illustrated.—Waterproof masonry.—Graduated beam sliding calipers, illustrated.—The Jackson ventilating grate, illustrated.—Iron frame palm house at the Exposition, illustrated.—Mineral wool and its uses.

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Business and Personal.

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"U. S." metal polish. India apolis. Samples free.

Best drying machines. S. E. Worrell, Hannibal, Mo.

Corliss engine wanted, 100 H P. Must be in good order and cheap. Box 116, Syracuse, N. Y.

Air compressors for every possible duty. Clayton Air Compressor Works, 26 Cortlandt Street, New York.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Wanted—A first class patented lock for folding paper boxes. Address Boxes, care of Scientific American.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Nickel-in-slot machines perfected and manufactured Electrical supplies, Waite Mfg. Co., Bridgeport, Conn.

Centrifugal Pumps for paper and pulp mills. Irrigating and sand pumping plants. Irvin Van Wie, Syracuse, N. Y.

65 ft. steam yacht, $3,850; also 25 ft. launch, $650. W. G. Nourse, assignee for Chas. P. Willard & Co., Chicago, Ill.

Carborundum—hardest abrasive known. Send for prices of wheels, powder, etc, The Carborundum Co. Monongahela, Pa.

Emerson, Smith & Co., Ltd., Beaver Falls, Pa., will send Sawyer's Hand Book on Circulars and Band Saws free to any address.

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Extensive stock of small engines and boilers (stationary and marine). *Must be sold.* W. G. Nourse, assignee for Chas. P. Willard & Co., Chicago, Ill.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

Patent Electric Vise. What is claimed, is timesaving. No turning of handle to bring jaws to the work, simply one sliding movement. Capital Mach. Tool Co., Auburn, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5887) W. W. asks: 1. I want to make gas from gasoline; will you tell me how to do it? A. By passing air over it enough will be taken up to produce a species of gas. The principal trouble is the chilling of the gasoline by the evaporation. 2. I have the bellows described in "Experimental Science." Can I use it for making the gas by passing a current of air over the gasoline? A. Yes.

(5888) H. E. R. writes: I am constructing a small storage battery to operate a two candle power lamp. The battery has four cells 1×1½×2½ inches. Size of plates ⅛×1¼×2. I would like to use a paste in the cells, as I want to put it on my bicycle. Can you inform me what kind of a paste to use? Will such a battery give eight volts? Will it operate the two candle power lamp, and how long charging will it require for about five hours by a dynamo giving out ten volts? A. The battery will give 8 volts, and should give amperage at the rate of 1 ampere per 24 square inches of positive plate immersed in a single cell. Thus, if you have but one positive plate in a cell, your amperage will be only about one-tenth ampere. Your lamp requires 4·5 to 5·5 volts and 1 to 1⅛ amperes. It will need about eight hours to fully charge the battery.

(5889) T. H. P. asks: Will you please inform me of the manner in which telephones should be connected where two instruments are used on each end of a line (metallic circuit), one as transmitter and the other as receiver? A. Connect one terminal of each telephone to the line and the other to earth, or if a metallic circuit is used, connect one terminal to each line terminal. It makes no difference in what order the connections are made.

(5890) F. E. C. asks for directions for transferring photographs on to glass. A. Flow dammar varnish over the plate. Let it dry overnight. Soak the photograph in water. When the varnish is tacky, carefully place the photograph on it face down and rub it on, excluding air bubbles. After the varnish is hard, rub off the back of the paper with the wet finger, dry and varnish.

(5891) A. H. M. asks: Can you give number of SUPPLEMENT on magic lanterns? A. For magic lanterns see SCIENTIFIC AMERICAN, No. 95, vol. 58, and No. 8, vol. 61; also our SUPPLEMENT for Megascope, No. 847; Stereopticon, No. 941.

(5892) F. W. C.—The plant sent for name is the long moss, *Tillandsia usneisdes.*

(5893) W. J. McC. asks: 1. In making a storage battery could I make the plates of ordinary sheet lead such as plumbers use, or would it be better to cast them? Also would ⅛ inch be thick enough, or would three-sixteenths be better? A. Three-sixteenths is better. There is no need of casting them. 2. In what proportion should I mix the sulphuric acid and redlead, with which to coat the plates? A. Use 10 per cent solution of acid with red lead, enough to make a paste. 3. Why is it better to have more negative than positive plates? Also, if I have 8 negative and 7 positive plates, each 7×8 inches, in each cell, what will be the number of ampere hours of each cell, and how do you calculate them? A. You need plenty of oxidizing capacity. Allow 6 amperes per square foot of positive plate immersed. 4. Could plates one-sixteenth inch thick be used, fastening three of them together to form a single plate? A. Yes. 5. Could I charge 2 storage cells from 6 gravity cells, and about how long would it take to charge? A. You would get one-sixteenth ampere; a total time of several weeks. 6. How do you calculate the number of volts necessary to charge a given number of cells? And does the amperage of the charging current have to be taken into account? A. Allow 5·3 amperes per square foot of positive plate and 2¼ volts per cell. 7. How thick must the paste be spread on the plates? A. About as thick as a coat of paint. 8. Could I tell by a hydrometer whether or not a cell was charged? If so, how? A. Yes. It is charged when the acid is of 1,200 sp. gr. 9. Could you recommend a book on storage batteries where I could find the information requested above? A. Solomon's "Voltaic Accumulators," $1.50 by mail. 10. In making a dynamo or motor, if the field magnets were made up of a number of cast plates, say ⅛ inch thick, bolted together, would it yield as good or better results than if they were cast solid? A. The solid are better for the field. Cast iron is bad for the armature. 11. If the plates were used, would it be better to place paper between them or paint them before bolting together? A. Armature plates should be of soft iron, with paper interposed. If you use cast iron plates for the armature, then separate with thin paper.

(5894) W. S. says: 1. Give the dimensions of the ship Great Eastern, that is, length, breadth, depth, and tonnage. What was her mission, did she ever make any successful voyages across the ocean? Was she propelled by steam or sails or both? What was her cost? How long in building? A. The length of the Great Eastern was 680 feet, breadth 83 to 114 feet, 58 feet depth. Tonnage 18,915 tons gross register. Cost $3,750,000. The Great Eastern was built for coal and passenger traffic. She made many voyages, but was never a success financially. The Great Eastern was propelled both by steam and sails. The vessel was six years in building. See SUPPLEMENT, No. 830, for full account of this vessel. 2. What is the average carrying capacity in tons of our modern steamships? A. The average carrying capacity of ocean steamers is now from 5,000 to 8 000 tons. The latest express passenger steamers are from 10,500 to 12,000 tons burden. 3. I have a common white pine door, and while the workmen were putting on an asbestos roof, they let some of the black paint drip on it, and I scraped it off two or three times, and have painted it over three coats of paint, but still it comes through almost as plain as at first. What can I do to remove the trouble? A. Burn off the paint over the spot with an alcohol lamp, then scrub with turpentine and afterward paint. 4. What is the capacity of a round tank, diameter 8 feet, depth 10 feet, the same size throughout? A. 3,756 gallons. 5. What can I put in a tea kettle to prevent scale or to remove same? A. We do not know how you can prevent scale in a tea kettle. Remove scale by scraping with a knife.

(5895) J. E. M. writes: Please inform me if the English form of dialyte telescope described in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 581, 582 and 583, gives good definition, and if it may be made achromatic by the dimensions given in the article. Also what power could be applied (the greatest) to a telescope of this description of 4 inch aperture and 48 inch focus, to give fair results? A. The dialytic telescope has been made of fine definition by good opticians, but amateurs have not had the best results. The central portions of the field may be made very fine in definition, but the edges are somewhat defective by aberration, principally chromatic. It is a cheap form and easy to correct by the range of movement of the correcting lens. Powers up to 250 may be used on this form of telescope.

(5896) C. G. K. asks: 1. How and of what a dry battery is made? A. There are many kinds. In some the exciting fluid is mixed with plaster of Paris, or oxychloride of zinc, in others gelatine or a similar substance is used. They have generally carbon and zinc electrodes. 2. Will I have to use a spark coil with above battery to produce a spark sufficient to ignite gas? If so, how made? A. You need a spark coil. On a core of iron wire 8 inches long and ¾ inch thick wind five pounds of No. 22 magnet wire. 3. How long will a dry battery last, used with a gas engine? A. It is impossible to say. It might last many weeks. 4. Why are gas engines so expensive? A. They are complicated in construction and have to be very accurately made. 5. If there are any SUPPLEMENTS treating on the above questions that thoroughly explain them, please give number. A. For dry batteries we refer you to our SUPPLEMENT, Nos. 157, 767, also the SCIENTIFIC AMERICAN, No. 20, vol. 61, No. 2, vol. 67, No. 7, vol. 68. For gas engines we refer you to our SUPPLEMENT, Nos. 715 and 716.

(5897) G. H. De L. asks: 1. What is meant by ampere hour? A. A flow of one ampere for one hour, or one-tenth ampere for ten hours, and so on. 2. How many 8 candle power lamps will an 80 ampere hour storage battery run, and how long will the battery run the lamps? A. You do not give the voltage of the battery or lamps. The query cannot be answered. 3. In charging a storage battery, how can it be known when it is fully charged? A. By the strong evolution of gas "boiling," or by the specific gravity of the solution, or by the color of the plates.

(5898) E. W. says: Please inform a reader of your valuable paper how to make a black glossy ink (writing fluid). A. Runge's Black Writing Fluid.—Digest ¼ pound logwood in fine chips for twelve hours in 3 pints boiling water, then simmer down gently to 1 quart, carefully avoiding dust, grease, and smoke. When cold decant the decoction and dissolve in it by agitation 20 grains yellow chromate of potash; it will then be fit for use. Or 30 parts extract of logwood are dissolved in 250 parts of water, 8 parts crystallized carbonate of soda and 30 parts glycerine (sp. gr. 1·25) are added; lastly, 1 part neutral chromate of potash and 8 parts gum arabic, reduced to a powder and dissolved in water. This ink does not attack pens, does not turn mouldy and is very black.

(5899) F. N. P. says: Please give me a receipt for artist's canvas, for oil painting. A. 1 part white lead, 2 parts whiting, a small portion of litharge and sulphate of zinc for driers; mix with equal parts of boiled linseed oil and raw linseed, tinted with either brown umber or lampblack, for a neutral ground. The canvas is tacked upon a stretching frame, and sized with weak glue size, to which a small portion of zinc sulphate is added. When dry it is stippled over with some driers and raw linseed oil, as thin as possible, not saturated. When very near dry the white lead, whiting, etc., is mixed up very smooth, and put upon it very thin and smooth with a large palette knife, and hatched over with a large sash tool, drawing it across one way and then at right angles until the face presents a face like a piece of fine linen or cartridge paper when it is left to dry.

(5900) W. J. asks if the bell must be cut out with a switch when using the telephone (described in No. 5 of the SCIENTIFIC AMERICAN) with only two stations. Or could it be used without a switch for cutting out the bell? A. Your arrangement of telephone as shown in your sketch is inoperative. If you want to leave the call bells in the circuit, place them in series with the telephone. This, however, introdnces a resistance which will seriously affect the working of the telephone.

(5901) W. E. V. asks: 1. I am building motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, but by mistake wound the field in the opposite direction to that given. Will it be necessary for me to rewind it? A. No. Connect each field terminal to the brush opposite the one designated. 2. I wish to run a rowboat with it. In what proportion should the gear wheel be, on the motor, to the one on the propeller shaft? A. About 1 to 10. 3. Is the battery described in "Experimental Science," page 408, Fig 403, suitable for running the motor? Is it manufactured? If so, by whom? A. This battery will answer for the motor, but any primary battery will be very cumbersome for a boat. For batteries address Queen & Co., Philadelphia, Pa.

(5902) A. H. W. asks: 1. Can a Sampson battery be made as good as new? If so, how? A. By replacing the contents of the central carbon some improvement should be effected. 2. Would new zincs assist in making it as good as new? A. New zincs are not needed as long as the original ones are intact.

(5903) C. H. writes: I am making an eight light dynamo. Could you suggest an easier and still equally good way of making commutator for the same than the one described in SUPPLEMENT, No. 600? I have not the tools for cutting the segments from the copper tube properly. A. We advise you to adhere to the instructions. You might use a cylinder of wood with strips of brass let into its surface, but it would be a very inferior construction. 2. What is the relative resistance of iron and copper wire? I have some No. 18 iron wire. Would that do to make a resistance box in the field circuit of eight light dynamo? A. Iron wire has six times the resistance of copper wire. Your wire will answer the purpose.

(5904) F. R. C. writes: Can you furnish us a formula for solder to use on plates of storage batteries, where they are immersed in the acid, and are subject to the chemical action? A. Use autogenous soldering or lead burning. Very low grade solder would probably answer your purpose.

(5905) A. N. D. asks: 1. How can a continuous current dynamo be connected as a motor to run by the alternating current? A. It cannot be so connected. 2. How can a small motor with a laminated armature, one about an inch in diameter and three inches long, be wound for ten volts and three amperes current? A. Wind the field with No. 18 wire, using nearly 3 pounds, or enough to give 3½ ohms resistance. The armature may have the same resistance, say 1,300 feet No. 20 wire. 3. How can a dynamo described in Fig. 496, in "Experimental Science," be wound to give voltage and current to run four or five motors described above, using laminated armature, using the Edison system of winding? What power would it take to run such a dynamo? What power would one of the above motors give? A. Use a laminated drum armature and wind with 500 turns of wire for each volt required. Use wire of capacity sufficient for amperage. Thus for 10 volts and 12 amperes you would need 5,000 turns No. 15 wire. For field, if in series, wind to two-thirds the resistance of the armature with the largest wire you can get on. Each of the motors described will absorb 1-24 horse power, and the dynamo driving them would absorb about 10 per cent more per motor.

(5906) B. A. asks: Do foundry irons receive their proportions of graphite from the fuel in the process of reducing the ore in the blast furnace, or are there certain ores which produce iron of a fixed percentage of carbon? What element is there in white iron which prevents the carbon from separating in the uncombined state? If this element was removed, would the iron be soft? A. The hardness of pig iron is due to the increase of combined carbon; all of which is derived from the fuel in the blast furnace. White iron may contain much less total carbon, so that none separates, there being not enough to separate it.

TO INVENTORS.

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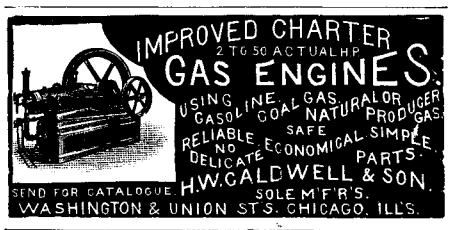

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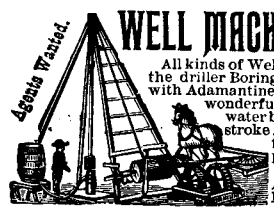

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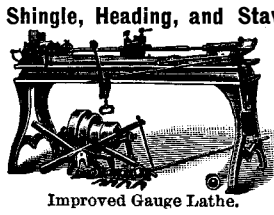

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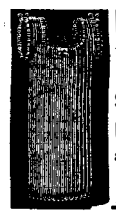

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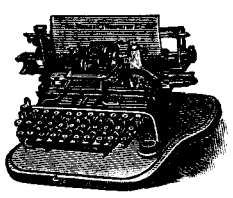

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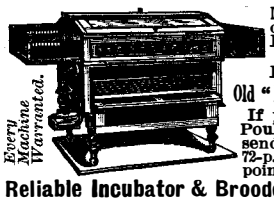

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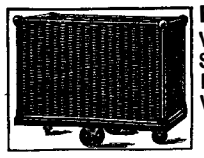

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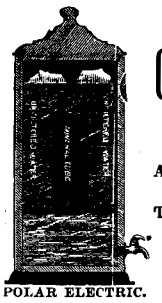

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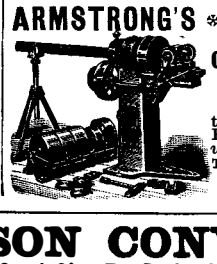

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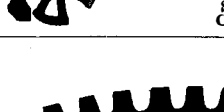

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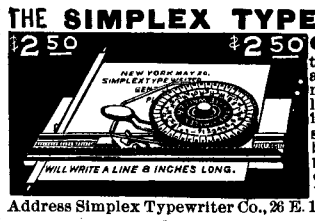

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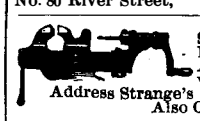

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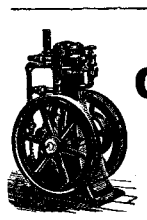

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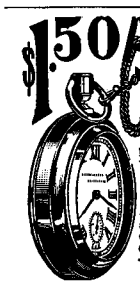

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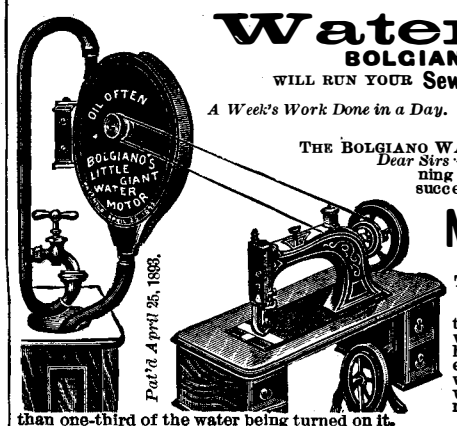

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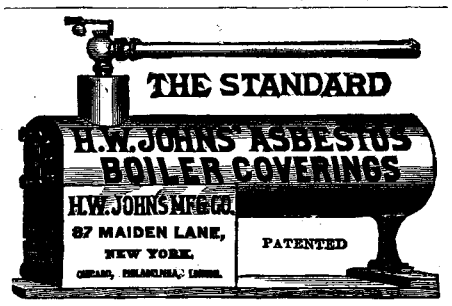

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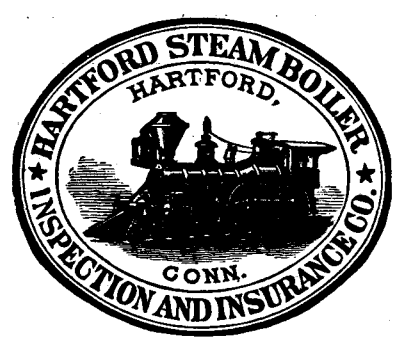

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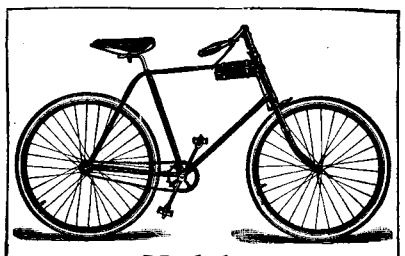

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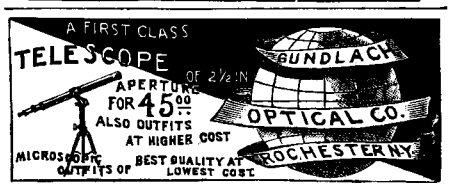

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